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HÆMORRHAGIC RETINITIS IN VOMITING OF PREGNANCY

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THE etiology of vomiting of pregnancy is still unknown. From the evidence to date it appears that a metabolic disturbance, particularly in the carbohydrate chain, may perhaps be an important etiological factor. Dehydration, starvation, and incomplete oxidation of fatty acids certainly play an important rôle in the production of the chemical changes noted in the blood and urine of a patient suffering from severe vomiting of pregnancy. These abnormal findings are usually a high ammonia nitrogen content in the urine, and a slightly increased non-protein nitrogen, decreased chlorides, increased uric and lactic acids, and accumulation of acetone bodies in the blood.

In many fatal cases of vomiting of pregnancy, characteristic lesions are present in the liver, which show as profound necrosis of the central portion of the lobule. Although many writers regard this lesion as characteristic of vomiting of pregnancy, it is conceivable that starvation, rather than the vomiting of pregnancy, may be the underlying cause of these hepatic lesions. On the other hand, we know from the work of Opie and others that central and midzonal necroses in the liver are usually the result of systemic poisoning, from which it would appear that vomiting of pregnancy may rest on a toxic basis.

Mack suggested that a toxin or poison produced by the fetus or placenta may be the cause of vomiting of pregnancy, and that normal pregnant women become immune to this toxin. No such toxin has, however, been isolated, and, it is conceivable that it may prove to be an intermediate or end-product of metabolism, rather than a foreign poison. It certainly seems that the neurotic element, as a factor in the etiology of the disease, has been greatly overemphasized in the past. All cases of vomiting of pregnancy are undoubtedly toxæmic in origin, although they may vary greatly with respect to the rôle which a neurosis may play in the course and prognosis of the disease.

We have been unable to find in the literature any reference to hæmorrhagic retinitis associated with vomiting of pregnancy. Recently we studied two such patients, and since the findings may be additional information in the search for the cause of this disease, they are here reported in some detail.

CASE 1. The first patient, a colored secundigravida, age 32 years, was admitted to the hospital March 3, 1931, having had her last menstrual period October 19, 1930, and complaining of severe vomiting. According to her history she had lost 26 pounds in weight during the 2 months preceding admission to the hospital. Physical examination showed some dryness of the skin, noticeable emaciation, but no jaundice. She was 5 months' pregnant and suffering from severe vomiting, which persisted in spite of treatment. Isolation, fluids, intravenous glucose solution, and small meals were of no avail. Nine days after admission the patient complained of blurred vision, and ophthalmological examination at that time revealed the fact that the discs were normal but that they were surrounded by several large areas of hæmorrhage. These hæmorrhages, which were present in both eyes, were retinal and subhyaloid in distribution, varying from a pin point to large patches. There was no arteriovenous compression and the arteries appeared to be quite normal except for some crinkling of the very small branches. No exudates or œdema could be detected. The impression was that the patient had hæmorrhagic retinitis with no obvious disease of the vessels of the retina.

The patient's condition became steadily worse, as indicated by the persistent vomiting, steady loss of weight and the development of partial blindness. Administration of intravenous glucose solution was continued, but failed to produce any improvement.

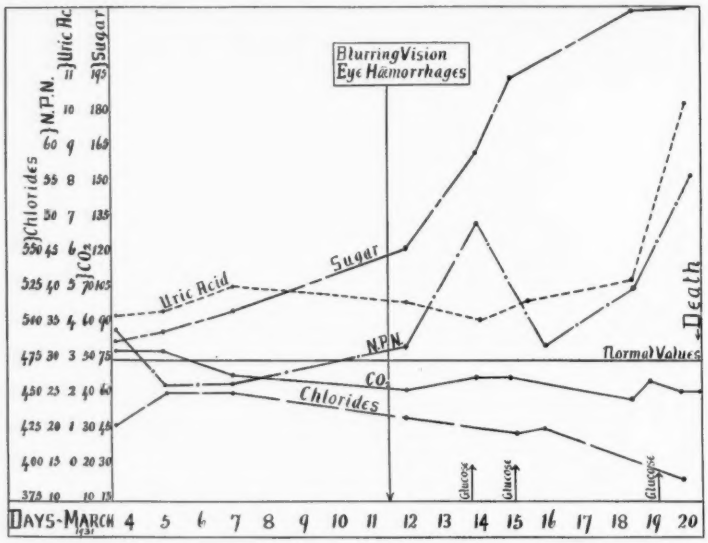

Chart 1. Urine and blood chemical analyses, Case 1.

On March 19, 1931, 16 days after admission the patient became irrational and drowsy. At this time the retinal hæmorrhages had increased greatly in extent. Neurological examination ruled out brain tumor. The pregnancy was terminated on this day, but the patient died the following afternoon.

Frequent and complete urine and blood chemical analyses were done and are reported in Table 1. These showed the typical changes seen in severe vomiting of pregnancy, and are plotted in Chart 1. The outstanding chemical changes were increased uric acid and sugar, and decreased chlorides and carbon dioxide combining power of the blood, and an elevated ammonia coefficient in the urine. The hyperglycæmia manifested itself before the initial administration of glucose.

Autopsy revealed central necrosis of the liver and numerous patches of necrosis, together with many hyaline capillary thrombi, in the anterior lobe of the hypophysis. These thrombi, according to the pathologist, may as well be secondary to the necrosis as the cause of it.

Case 2. Our second patient with hæmorrhagic retinitis was a 23 year old white primigravida, who had her last menstrual period on March 14, 1931. She was admitted to the hospital on June 22, 1931, complaining of severe vomiting and 30 pounds loss in body weight. Physical examination showed emaciation, dryness of skin, very slight jaundice, and a 4 months' pregnancy. Isolation and routine treatment for vomiting of pregnancy were at once instituted. Her condition became steadily more serious, the treatment, together with frequent glucose injections proving of no avail. Nine days after admission she complained of blurred vision, at which time ophthalmological examination revealed many areas of subhyaloid hæmorrhages, quite similar to those observed in the first patient. The eye-ground changes at this time are shown in Figure 1. The findings in this patient's blood chemistry are shown in Table 11 and show the typical changes of low chlorides, and slightly decreased carbon dioxide combining power. It is interesting to note that the blood uric acid showed normal values, contrary to the usual findings of increased amounts in severe vomiting of pregnancy. The blood sugar is within normal limits, excepting after the intravenous administration of glucose.

In view of our experience with the first patient it was decided immediately to terminate this pregnancy and a therapeutic abortion was at once done, followed by intravenous glucose administration.

The patient's condition remained unchanged for the first 4 days following the abortion, at the end of which time she began to show slight but steady improvement. Her convalescence was slow and it was not until 3 weeks after the termination of pregnancy that she was discharged from the hospital in good condition.

The blurred vision persisted during the first 2 weeks following operation and then gradually disappeared. At discharge from the hospital, ophthalmological examination revealed a few small hæmorrhagic areas still present, although the condition was greatly improved as can be seen by comparing Figures 1 and 2, the latter representing the eye-ground picture at discharge.

The 2 patients whose histories are here reported, both developed hæmorrhagic retinitis while suffering from severe vomiting of pregnancy. Termination of pregnancy was performed in both cases, but while it was done 8 days after the first complaint of blurred vision in the one it was instituted immediately after the appearance of this complaint in the other patient. The latter recovered while the former died shortly after the termination of pregnancy.

In the fatal case autopsy revealed central necrosis in the liver and necrotic areas in the ante-

TABLE I.—URINE AND BLOOD CHEMICAL ANALYSES, CASE 1

Date	Urine				Blood						Remarks
	Acetone	Diacetic	Urea N %	NH_3-N %	N.P.N.	Urea N	Uric Acid	Chlorides	Sugar	CO_2	
3-3-31	o	o	74.5	5.0	34.5	18.0	4.2	429	85	50.0	Admitted to hospital
3-5-31	+	+			20.5		4.4		83	52.2	Fluids by mouth
3-7-31	o	o			20.8		5.3		96	45.7	Condition worse
3-12-31	o	o			33.3		4.5		121	41.9	Blurred vision appeared
3-14-31	o	o			50.0		4.7		164	44.7	Intravenous glucose
3-15-31	+	+			30.9		4.1	425	182	44.7	Slightly improved
3-18-31	+	+			39.5		5.2	427	250	39.0	Intravenous glucose
3-19-31	+	+		6.5			6.8		290	44.3	Pregnancy terminated
3-20-31	+	+	68.5		53.6	30.0	10.4	383	400	41.0	Lactic acid 69. Amino acids 50. Died 3 p.m.

TABLE II.—URINE AND BLOOD CHEMICAL ANALYSES, CASE 2

Date	Urine				Blood						Remarks
	Acetone	Diacetic	Urea N %	NH_3-N %	N.P.N.	Urea N	Uric Acid	Chlorides	Sugar	CO_2	
6-22-31	+	+	68.8	8.8	38.9	20.5	4.2	415	118	35.3	Admitted to hospital
6-27-31	+	+			23		2.1	468	97	40.9	Slightly improved, fluid by mouth and infusion
6-30-31	+	+			22.8		2.4	435	82	37.2	Headache
7- 1-31	+	+			18.0		1.3	495	68	31.0	Blurred vision, hæmorrhagic retinitis
7- 3-31	+	+			20.0		1.8	400	75	30.0	Pregnancy terminated
7- 7-31	o	o			26.0		1.1	383	103	46.6	Improved intravenous glucose
7-11-31	o	o			28.8		1.5	420	77	48.5	Improving steadily
7-16-31	o	o			30.6		2.5	490	71	56.9	On ward diet
7-18-31	o	o	78.9	3.4	31.0	14.8	2.5	495	78	57.0	Discharged well

rior lobe of the pituitary gland. There is no very good explanation for the hypophyseal necrosis other than that some unknown poison or toxin or metabolic product, associated with the toxæmia of vomiting of pregnancy, had caused the necrosis in both liver and hypophysis. It is interesting to note that in this patient there was a hyperglycæmia, and it is conceivable that the high blood sugar might have been associated with the lesion in the hypophysis. We have previously noted similar lesions in the pituitary gland in 2 fatal cases of vomiting of pregnancy, 2 cases of eclampsia, and 1 case of chronic nephritis during pregnancy.

It seems logical to assume that the hæmorrhagic retinitis is associated with, and a result of, the vomiting of pregnancy toxæmia. This appears to be substantiated by the fact that the retinitis cleared up in the second patient, in whom termination of pregnancy was done early enough to bring about complete recovery. From our experience in these 2 cases, the appearance of hæmorrhagic retinitis in patients suffering from vomiting of pregnancy must be regarded as a grave prognostic sign and an absolute indication for immediate termination of pregnancy. Routine and repeated ophthalmological examinations in all patients suffering from vomiting of pregnancy seems essential. Attention should also be paid to any complaints of disturbed vision.

From a study of the drawings of the eye-grounds as shown in Figures 1 and 2 (frontispiece), it is apparent that the hæmorrhages are of a diffuse character and quite different from the hypertensive or arteriosclerotic type. One gains the impression that there is an escape of blood cells or diffusion of blood elements through the capillary walls due to injury to, or change in permeability of, these vessel walls. The liver lesion, the necrosis in the hypophysis, as well as these changes in the capillary walls may be due to a single agent or substance, toxic in character.

CONCLUSIONS

1. Hæmorrhagic retinitis appearing during the course of vomiting of pregnancy is of grave prognostic significance, and an indication for therapeutic abortion.

2. Routine and repeated eye-ground examinations should be conducted on all patients suffering from severe vomiting of pregnancy.

3. The character of the hæmorrhagic retinitis seen in 2 cases of vomiting of pregnancy makes it probable that the eye lesion is caused by a change in the permeability of the capillary walls.

4. Necrosis in the anterior lobe of the hypophysis is sometimes seen in fatal cases of vomiting of pregnancy.

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CLINICAL AND EXPERIMENTAL BASIS FOR SURGERY OF THE PELVIC SYMPATHETIC NERVES IN GYNECOLOGY

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FUNCTIONAL disturbances of the pelvic sympathetic nerves are frequently responsible for severe intractable dysmenorrhœa from which relief is rarely obtained by the ordinary methods of treatment. These functional or intrinsic types of dysmenorrhœa together with the severe neuralgias associated with inoperable neoplasms in the pelvis offer an important field for surgery of the pelvic sympathetic nerves.

In 1898, Jaboulay attempted to relieve pelvic neuralgia by interrupting the afferent pathways in the sacral sympathetic chains. In one patient he disarticulated the coccyx, then, after freeing the rectum from the hollow of the sacrum, he was able to resect a small portion of the sacral sympathetic chain of one side and divide it on the opposite side. In the second patient he freed the rectum from the hollow of the sacrum and displaced it anteriorly with the hope of pulling apart the anterior branches of the sacral plexus. These operations, however, were successful only in relieving the pelvic neuralgia for a short time. About one year later, Ruggi published his interesting work on abdominal sympathectomy in functional disturbances of the female genital organs. He advised the resection of the utero-ovarian plexus by the transperitoneal route. His reports show that the operation was frequently followed by a complete disappearance of the pelvic pain. Nevertheless, the work of both Jaboulay and Ruggi failed to hold the attention of the other surgeons of that time and, as a result, these procedures were quickly discarded and forgotten.

In 1921, Professor Leriche made a complete study of the pelvic sympathetic nerves in relation to pelvic neuralgia and he introduced the peri-arterial sympathectomy of the internal iliac (hypogastric) artery as a means of relieving the pain in cases of functional dysmenorrhœa. This procedure was widely accepted in Europe and from the results published by Leriche, Cotte, Hallopeau, and Michon, the operation gave complete and lasting relief from pain in the great majority of the cases. In 1925, Cotte found that section of the superior hypogastric plexus (presacral nerve of Latarjet) also gave complete relief in cases of functional dysmenorrhœa. Since the section of the superior hypogastric plexus proved to be much simpler from the technical standpoint he suggested it as a substitution for the more complicated operation of peri-arterial sympathectomy of the internal iliac (hypogastric) artery.

The very gratifying results that have been obtained by the various operations upon the pelvic sympathetic nerves for the relief of pelvic neuralgia seem to us to justify this present work. However, before entering into the details of the surgery of these nerves, it will perhaps be wise to review briefly the anatomy and physiology of the entire pelvic sympathetic nervous system.

MACROSCOPIC ANATOMY OF THE NERVES TO THE FEMALE SEX ORGANS

The innervation of the ovary. The ovary derives its nerve supply mainly from the ovarian plexus. This plexus arises from the intermesenteric and renal plexuses and follows the ovarian artery throughout its entire course (Fig. 1). According to Hovelacque three fibers arise from the middle of the renal plexus to join the ovarian plexus. Petit-Dutaillis and Flandrin (1923) have also demonstrated fibers arising from the lateral edge of the renal plexus. These fibers unite with the fibers from the intermesenteric plexus. As early as 1783, Walter demonstrated ganglion cells interposed between these fibers. The number of the fibers is not constant; occasionally, however, they are so numerous as to form a true plexus. Hovelacque states that this group of nerves is usually combined into a single or, at the most, two main nerve trunks. Dahl (1924) and Laux (1927), however, represent them as a true plexus formation.

The ovarian plexus enters the suspensory ligament of the ovary and divides into an external tubular branch which supplies the fallopian tube and one or several internal branches which go to the hilum of the ovary. Five or six terminal filaments of the external tubular branch course through the broad ligament and reach the lateral border of the uterus (Fig. 2). According to Lhermitte and Dupont (1925), Segond (1926), and Hovelacque (1927), there is no anastomosis between these filaments and the plexus of nerves which accompanies the uterine artery and its branches. Morrisson-Lacombe (1920), on the contrary, states that there is an anastomosis between these fibers.

The innervation of the uterus. The nerve fibers in the wall of the uterus are derived from the great plexuses of Frankenhaeuser (1867) which are situated on either side of the body of the uterus in the broad ligament. These plexuses are made up of fibers from both the hypogastric and sacral plexuses. The hypogastric plexus (Fig. 3) is arbitrarily divided into two parts, the inferior part being called the inferior hypogastric plexus and the superior part, the part which has been given so many special names, is now commonly called the superior hypogastric plexus. Some of the special names that have been applied to the superior hypogastric plexus in the past are plexus sousmesentérique (Winslow, 1732); nervus uterinus magnus (Tiedemann, 1822); nexus ganglionnaire lamelliforme (Bourgery, 1844); plexus uterinus magnus (Frankenhaeuser, 1867); plexus interiliaque; nerf présacré (Latarjet and Bonnet, 1913), and nerf prélombaire (de Rouville, 1927).

The superior hypogastric plexus has been described by Hovelacque as essentially a continuation of the intermesenteric plexus below the inferior mesenteric artery, and it includes that portion of the plexus which extends from the superior part of the fourth lumbar vertebra to the middle of the first sacral vertebra. There it divides into two terminal plexuses called the right and the left *inferior hypogastric plexuses* (Fig. 4.). Delmas and Laux (1927) state that the important branches to this plexus come from the lumbar sympathetic chains. They also believe that the fibers from the first and second lumbar ganglia are the principal roots which strengthen the thin branch from the inferior mesenteric plexus and the branches from the third and fourth lumbar sympathetic ganglia. These roots make up the *superior mesenteric plexus* similar to the manner in which the splanchnic nerves are formed; consequently, the branches are frequently referred to as the pelvic splanchnic nerves.

The terminal branches of the intermesenteric plexus unite in an extremely variable way to form the superior mesenteric plexus. Ganglion cells have been demonstrated in the plexus formed by these branches; consequently, the point of convergence of the roots has been given the name of the inferior mesenteric ganglion.

The *inferior mesenteric plexus* gives rise to the right and left mesenteric nerves. These nerves unite at a point about 1 inch below the origin of the inferior mesenteric artery to form the beginning of the *superior hypogastric plexus* (*presacral nerve*). The branches from the left side pass obliquely downward while the branches from the right pass posterior to the artery. There are usually many fine anastomoses between these nerves so that a true plexus is formed. This plexus is situated just anterior to the bifurcation of the aorta and separated from it by a thin layer of fascia. The plexus then follows the curve of the sacrum into the pelvis. There is usually a slight deviation of the plexus to the left. The midsacral artery is separated from the posterior surface of the plexus by a dense layer of fascia. Anteriorly the plexus is covered by a thin layer of loose connective tissue and the parietal peritoneum. In thin individuals the superior hypogastric plexus can easily be seen through the peritoneum. The root of the mesentery of the sigmoid colon is situated to the left.

There are many slight variations of the superior hypogastric plexus but none of them is of very great importance. Roussel (1926) made a very complete study of these variations. All of the recent studies, especially those of Segond (1926) and Hovelacque (1927), have shown the plexus to consist of a veritable network of nerve fibers. The description of the plexus by Latarjet and Bonnet (1913)

pictured these fibers as united into a single nerve trunk; consequently, they gave it the name of "pre-sacral nerve." Numerous studies have been carried out to clarify this question, but in spite of all of the work the facts are still contradictory. Ferey (1926) found a single nerve in only 15 per cent of the 13 dissections which he made. A definite plexus formation was found in the remaining 85 per cent of his dissections. In a series of 80 dissections, Delmas and Laux (1927) found that in 20 per cent of the cadavers the roots were joined together thus forming a true nerve, while in the remaining 80 per cent of the cadavers the nerves were more or less spread out in a plexus formation. Roussel (1926), on the contrary, found a single nerve in 75 per cent of his dissections, a plexiform formation in 20 per cent, and a true plexus with broad meshes in only 5 per cent of the dissections. It has been our experience that the nerves are usually in a plexus formation and rarely combined into a single nerve trunk. In introducing the section of the superior hypogastric plexus into gynecological surgery, Cotte (1925) accepted the description of Latarjet and Bonnet (1913) and consequently named the operation the "section of the presacral nerve." This name has remained prevalent in France so that we shall make use of it frequently throughout this work but only with the understanding that we do not refer to a single nerve trunk but to a variable number of filaments of a great plexus formation.

A few nerve filaments from the superior hypogastric plexus course along the common iliac arteries. The plexus itself continues down over the promontory of the sacrum and at about the level of the first sacral vertebra divides into two distinct nerves called the *inferior hypogastric nerves* (Fig. 3). Delmas and Laux (1927) describe this division as taking place just above the promontory of the sacrum.

The inferior hypogastric nerves. These nerves are usually between 2 and 3 inches in length and course obliquely from above downward in the lateral rectal space. They course along the internal iliac arteries and give off branches which accompany the branches of these arteries; other branches course medially and terminate in the rectum. The lateral sacral vessels lie slightly medial and posterior to these nerves (Latarjet and Rochet, 1922). The principal ureteral nerves are derived from these inferior hypogastric nerves. After these branches have been given off, the two inferior hypogastric nerves terminate in a mass of nerve fibers and ganglion cells which has been named the *hypogastric ganglion* (Fig. 5) by Lee (1849) and Frankenhaeuser (1867). The actual existence of such a ganglion is debatable. Hovelacque (1927) has defined the "so called ganglion of Frankenhaeuser" as the anterior part of the inferior hypogastric plexus. Dahl (1916) made an histological study of that part of the plexus and he was able to demonstrate occasional masses of ganglion cells within the meshes of the nerve fibers. Lee (1849), Frankenhaeuser (1867), Robinson (1894), Hashimoto (1904), Jung (1905), and Kehrer (1910) have all considered it a true sympathetic ganglion. Latarjet and Rochet (1922) have described the ganglion as a greyish-white felting in the form of a quadrilateral mass the limits and dimensions of which are difficult to fix. The inferior hypogastric nerve is continuous with the medial surface of this mass. The visceral branches to the pelvic organs are derived from the medial surface of the mass while there is a rich anastomosis with the sacral nerves on the lateral surface. The entire mass of ganglion cells and nerve fibers which make up this hypogastric ganglion is situated in the superior pelvic space between the peritoneum and the fascia covering the levator ani muscles. The plexus reforms on the anterior surface of the rectum just posterior to the uterus and vagina and becomes intimately connected with the uterosacral ligaments. Blaisdell (1917) has studied this connection and believes it to be a most important formation. Between the lateral border of the hypogastric plexus and the levator ani muscles are situated the internal iliac vessels. These large vessels are separated from the plexus by the thin genitopelvic aponeurosis. The uterine artery passes over the anterior surface of the plexus. Condamin (1927) has recently revived the old procedure of cutting the uterosacral ligaments for the purpose of relieving pelvic pain that is asso-

ciated with retroversion of the uterus or menstrual irregularities. This procedure was very popular in Europe many years ago, but at that time the improvement which followed this operation was thought to be due to some mechanical reason. In the light of the recent anatomical studies, it is evident that this operation was in reality a masked sympathectomy (Fig. 6).

Afferent branches of the hypogastric ganglion. The afferent branches course to the second and third sacral sympathetic ganglion and carry the impulses through the sacral sympathetic chains. According to the original description by Lee (1849), these branches are usually very thin and not constant as to their course or termination. Eckhard (1862) named these branches the "erector nerves" and Bishop Harman (1899) called them the "pelvic splanchnic nerves." The parasympathetic fibers that come from the sacral roots are the more important. The origin of these fibers varies somewhat according to the author. Cordier (1921) states they arise from the first to fourth sacral roots; Latarjet and Rochet (1922) believe they arise from the second to third sacral while Hovelacque (1927) states they arise from the third to fourth sacral roots. Laux (1927) has demonstrated fibers that connect the hypogastric plexus with the hypogastric ganglion. Hovelacque states that there is constantly a branch which connects the superior hæmorrhoidal plexus with the hypogastric ganglion.

Efferent branches of the hypogastric ganglion. The efferent uterine nerves are divided into two groups. The principal group is made up of fibers from the anterior part of the hypogastric ganglion while the accessory group is made up of fibers from the vesical branches. These nerve fibers form a resistant network about the uterosacral ligaments. The majority of these fibers reach the uterus and are distributed to the lower two-thirds of that organ. Latarjet and Rochet (1922) have named one of these branches the "lateral nerve of the uterus." This nerve may arise either from the inferior hypogastric nerve of that side anterior to the hypogastric ganglion or directly from the hypogastric ganglion. It passes anterior to the ganglionic mass and posterior to the uterine artery, then courses to the lateral border of the uterus, and ascends to the insertion of the round ligament (Fig. 5).

Since the efferent nerves to the rectum, ureter, and bladder are not concerned with this present problem we shall omit them entirely.

The nerves of the vagina. These nerves come from the anterior part of the hypogastric plexus and from the vesicovaginal branches of that plexus (Latarjet and Rochet), while a few filaments come from the sacral roots. According to Kuntz (1930), nearly all of the more recent investigators have described a relatively simple plexiform arrangement of nerves which include small ganglia and which are situated in the upper and middle part of the vagina.

MICROSCOPIC ANATOMY OF THE NERVES TO THE FEMALE SEX ORGANS

During the past few years considerable investigative work has been carried out to determine the constitution of the peripheral sympathetic nervous system. The work of Cotte and Noël (1927) and of Leriche and Fontaine (1929) has emphasized the fact that ganglion cells are present along the course of the intermediary nerve trunks as well as in the meshes of the great plexuses of nerves in the pelvis. It is impossible to separate the individual nerves from these plexuses and masses of ganglion cells. The important fact is that the entire sympathetic innervation of the genital organs, as well as the sympathetic innervation of all other viscera, is in the form of a vast plexus of nerves, the meshes of which are sometimes wide while at other times the fibers are matted together with small masses of ganglion cells scattered along the entire course of the nerves. For this reason, one should not consider the peripheral sympathetic nervous system as consisting of separate ganglionic centers that are connected by intermediate nerve fibers which act only as peripheral conductors of nervous impulses.

Intrinsic innervation of the ovary. Among the early investigators Frankenhaeuser (1867), Waldeyer (1870), and Ellischer (1876) described the intrinsic nerves of the ovary as supplying the ovarian follicles as well as the

blood vessels, but Vedeler (1890) was unable to demonstrate fibers which enter the follicles. Other observers, such as Riese (1891) and Von Herff (1892), described nerve fibers in the ovary as penetrating the membrana propria and terminating in the stratum granulosum of the follicular wall. Von Herff (1896) described cells which he regarded as ganglion cells within the ovary, but later he was unable to substantiate that claim. Cromaffin cells have been described in the stroma of the ovaries. Kuntz (1919) made a very careful and complete study of this problem. He found an abundant nerve supply to the blood vessels and fibromuscular tissue in the stroma but no nerve fibers which either penetrated the ovarian follicles or terminated in relation to them. He and his pupils were also unable to demonstrate any nerve supply to the interstitial secretory tissue. Ganglion cells were not observed within the ovary in any of the preparations which they studied. Walter (1782) and Dahl (1916) have demonstrated ganglion cells along the ovarian nerves but never actually within the ovary or fallopian tubes. Lee (1849) described a large ganglion at the level of the tubo-ovarian angle. According to von Koellicker (1894) and Dahl (1916), the great majority of the nerve fibers which supply the ovary and fallopian tube are unmyelinated, but occasional myelinated fibers have been found interposed.

Intrinsic innervation of the fallopian tube. The fallopian tube is supplied by both unmyelinated and myelinated fibers derived from the ovarian and uterine plexuses. According to Kuntz (1930), the nerve fiber bundles penetrate the wall of the tube and give rise to branches which are distributed to all layers except possibly the mucous epithelium. A definite plexiform arrangement of these fiber bundles is not apparent. Von Herff (1892) supported the theory that nerve fibers penetrate the mucous epithelium and terminate in relation to the epithelial cells. He also claimed to have observed ganglion cells in the wall of the tube. Dahl (1916) described nerve fibers in all the layers of the fallopian tube except in the mucous epithelium. He observed very fine branching fibers which approach the epithelium very closely but he could not determine if they actually terminated in relation to the epithelial cells. He showed that the nerve supply is most abundant toward the uterine end of the tube. He did not find a definite plexiform arrangement of the nerve fibers in any part of the tube, nor did he observe ganglion cells in the tube or broad ligament (Kuntz, 1930).

Intrinsic innervation of the uterus. The nerve fibers in the wall of the uterus are distributed mainly to the uterine musculature. Some of the older investigators maintain that nerve fibers also terminate in relation to the uterine mucosa, but, according to Kuntz, the majority of the data available at present does not support this view. Dahl states that the bundles of nerve fibers run parallel to adjacent bundles of muscle fibers to which they give off branches and these branches terminate in relation to muscle cells. He also states that the nerve supply is quite uniform throughout the uterus except in the region of the fallopian tubes, where it is especially abundant. He was able to trace nerve fibers as far as the mucosa but he never observed nerve fibers actually within the mucous epithelium. Many investigators, notably Remark, La Torré (1907), and Kieffer (1920), have described elements in the wall of the uterus in the human and animal species which they interpreted as ganglion cells; others found no true ganglion cells within the uterine wall (Frankenhaeuser and Dahl). Medowar (1928) states definitely that he could not find intramural ganglion cells in the uterus of the dog. Kuntz feels that in all probability true ganglion cells have been observed in the wall of the uterus in some instances, but that they must be regarded as cells which became displaced from the ganglia in the uterovaginal plexus during the course of development.

PHYSIOLOGY

It has long been the classical teaching that the hypogastric plexus exerts a vasoconstrictor action on the vessels of the internal genital organs while the parasympathetic nerves (nervi erigentes) exert a vasodilatory effect. The sympathetic nerves inhibit the secretion of the genital glands while the parasympathetic nerves stimulate the glands to secretion.

The exact control of the motility of the uterus is still unknown. Langley and Anderson (1895) have shown that the center of uterine contractions for the rabbit is situated between the tenth dorsal and the second lumbar segment of the spinal cord. Dahl considers the sympathetic fibers as the excitors while the parasympathetic fibers are the inhibitors of uterine contractions. Roehrig (1879), Kehrer (1910), and Hofmann (1926) consider the sympathetic fibers as the motor nerves to the circular muscle fibers and the parasympathetic fibers as the motor nerves to the longitudinal muscle fibers of the uterus. Bach and Hofmann (1926) believe that fibers from the hypogastric plexus control the opening of the cervix of the uterus and impulses through the nervi erigentes cause the cervix to close. Finally Berger (1923) and Dahl (1924) have expressed the theory that the sympathetic nerves take on the function of excitors to the uterus during pregnancy. Thus we see that our ideas concerning the influence of the sympathetic nerves on the function of the internal genital organs in the female are still vague and incomplete.

During the past year we have been especially interested in studying the influence of the pelvic sympathetic nerves upon menstruation and parturition, the two normal functions of the internal genital organs of the female.

The pelvic sympathetic nerves in relation to menstruation. The section of the superior hypogastric plexus does not alter the normal menstrual cycle. However, if the last regular menstrual period ended more than 4 or 5 days prior to the section of the superior hypogastric plexus there will appear an atypical or supplementary "menstrual period" on about the second postoperative day. We are inclined to believe that this is the result of an intense uterine congestion which follows the pelvic sympathectomy, and so it should not be considered as a true menstrual period. The subsequent menstrual period appears about 28 days after the pre-operative period and not in relation to the supplementary postoperative hæmorrhagic discharge from the uterus.

From the experimental standpoint, the work of Bouin and Courrier (1929) and of Buchheim and Zaleski (1930) throws some interesting light on this question. These investigators transplanted fragments of one horn of the uterus to the subcutaneous tissue of the ear of the same adult rabbit. The grafts took very well. Under the influence of an unfertile coitus which caused the follicular rupture and the formation of the corpus luteum, the mucosa and muscularis layers of the grafted fragments of uterus underwent histological changes that were identical with the changes that took place in the horn of the uterus that remained in place in the abdomen. When the grafts were at rest only a slight hyperæmia and œdema of the chorion were produced by cervical sympathectomy. If, however, the cervical sympathectomy was done several days before the follicular rupture and the subsequent production of the corpus luteum, the structural changes were found to be much more marked on the side on which the cervical sympathectomy was performed. These studies show that the lutein hormone exercises its action outside of all nervous influences but that the effect of these hormones can be augmented by increasing the vascularity of the part.

The pelvic sympathetic nerves in relation to childbirth. The classical experiments of von Goltz and the clinical observations of Mueller, Brachet, and Gertsmann have demonstrated clearly that neither the section nor the complete destruction of the sacral part of the spinal cord will prevent childbirth but only make it necessary to apply forceps to the head of the child low down in the birth canal because of the paralysis of the perineal and vulvar muscles. Rein (1882) has reported the spontaneous birth of young in rabbits following the section of all the extrinsic nerves to the uterus. There are also many cases on record in which normal parturition took place in patients who had previously been subjected to a resection of the superior hypogastric plexus for the relief of some painful condition in the pelvis.

The fact that section of the extrinsic genital nerves does not alter the normal menstrual cycle, does not interfere with spontaneous parturition, does not produce glandular atrophy, chronic pelvic congestion or any disturbances

of motor function of the bladder or rectum, seems to us to be clinical evidence that these genital nerves of the sympathetic nervous system are sensory rather than motor in nature. The experimental studies of Leriche and Stricker (1927) show that the nerves of the superior hypogastric plexus carry afferent impulses. They studied the influence of stimulation of the presacral nerve upon the blood circulation in the dog. One cannula of François Frank was inserted in the central end of the carotid artery and another was inserted in the peripheral end of the internal iliac artery. Excitation of the superior hypogastric plexus (presacral nerve) gave an immediate rise in both the general and peripheral blood pressure. After a short time there was a gradual drop in the pressure in both arteries. The curves of the pressure in the iliac and the carotid arteries showed relatively the same variations. The superior hypogastric plexus was then cut and the peripheral end was stimulated with an electric current. Neither the general nor the peripheral circulation was influenced by this stimulation. However, when the central end of the cut nerve trunk was stimulated in a similar manner the general and the peripheral circulation was modified to the same extent as when the intact nerve trunk was stimulated. The stimulation of the intact nerve or the central end after the nerve had been cut caused the animal to awaken from the deep general anæsthesia and groan as though it was suffering from intense pain. Stimulation of the peripheral end of the cut nerve trunk caused no action of that kind.

Latarjet and Rochet (1922) have expressed the theory that the severe pain associated with pathological processes in the region of the uterosacral ligaments and in the retrocervical region is due largely to stimulation of the hypogastric ganglion.

AFFERENT NEURONS OF THE SYMPATHETIC NERVOUS SYSTEM

The existence of sympathetic neurons which are incorporated in conducting pathways through which afferent impulses are conveyed into the central nervous system is still a matter of great dispute, yet considerable anatomical and physiological data are available which show clearly that the myenteric and submucous plexuses contain reflex mechanisms and are capable of carrying out co-ordinated reflex activities independent of the central nervous system. In 1874, Sokownin demonstrated that stimulation of the central end of a severed hypogastric nerve caused a symmetrical contraction of the urinary bladder even after the inferior mesenteric ganglion had been severed from all medullary centers. These experimental results which show the rôle played by the reflex centers in the inferior mesenteric ganglion were confirmed by Courtade and Guyon (1895) and Laignel-Lavastine (1903). All of these results add further proof to the work of François Frank in regard to the sympathetic reflexes. Langley and Anderson (1893) obtained the same results as Sokownin, but, since the observed reaction persisted after complete disarticulation of the synapses by nicotinization of the ganglion, they concluded that the reaction was due to an "axon reflex." Inasmuch as they thought the reflexes depended upon afferent conduction through preganglionic fibers, they gave them the complete name "pre-ganglionic axon reflexes." According to this theory there are no true sympathetic reflexes but efferent fibers have the ability of conducting impulses in the opposite direction (antidromic manner); consequently, no need exists for a real reflex that requires the integrity of the synapses in the sympathetic ganglia. We feel that fibers that have the ability of conducting impulses toward the central nervous system should be called afferent fibers rather than efferent fibers with the ability of conducting nervous impulses in an antidromic manner. In the light of the recent histological studies of Leriche and Fontaine showing that ganglion cells are present along the nerve trunks and scattered throughout the various sympathetic nervous plexuses (Fig. 7), it is quite probable that all the synapses were not disarticulated by the local application of nicotine or even by the intravenous injection of that drug. The other factor, namely, the absolute specificity of nicotine for all the synapses of the sympathetic ganglia is a question that we are not qualified to discuss.

The experimental studies of Sokownin, Gianuzzi, Latarjet, and Rochet demonstrate clearly that the hypogastric plexuses also contain efferent fibers to the urinary bladder. Partial paralysis of the bladder with marked urinary retention follows the removal of one superior hypogastric *ganglion* while the removal of both of these ganglia gives complete paralysis of the bladder muscles with subsequent marked distention and an inability to micturate spontaneously. However, after the simple removal of the superior hypogastric plexus (presacral nerve) disturbances of micturition or transient retention of urine must be considered as extremely rare. Such cases of disturbances of the function of the bladder have all been transient and of no serious consequence. Brocq reported one case in which the partial retention of urine lasted for 9 days after the operation. Recently, on the other hand, Learmonth and Braasch (1930) employed the resection of the presacral nerve in the treatment of a "cord bladder" with gratifying results.

One of our patients (Case 18) returned to the clinic 2½ months after the resection of the superior hypogastric plexus because of lower abdominal pains due to a marked distention of the bladder. There was no evidence of urinary infection. After being catheterized regularly for several days she regained the function and she has had no further urinary disturbances since that time. In cases of acute retention of urine which immediately follow an operation in the pelvis, the question of trauma to the bladder during the operation must always be considered.

We feel that the hypogastric plexuses carry the important pathways of sensation from the internal genital organs to the medullary centers and that the section of the superior hypogastric plexus (presacral nerve) above the hypogastric ganglion is a safe, simple, and efficacious way of interrupting these pathways in the treatment of the functional type of dysmenorrhœa as well as a method of relieving other forms of severe pelvic pain.

SURGERY OF THE PELVIC SYMPATHETIC NERVES

I. *Indications for the operations.* Since the pelvic sympathetic nerves are essentially afferent in nature they regulate the functional co-ordination of the internal genital organs and by reflex action control their vascularity, the secretion of their mucous membranes and their entire visceral sensibility; consequently, all operations upon this system of nerves are primarily directed toward the interruption of the ascending pathways of pathological reflexes and to sever the afferent fibers from the internal genital organs with the resulting abolition of the pelvic pain. The cases in which pelvic sympathectomy is indicated can, therefore, be divided into three main groups:

Group A. Those cases in which no organic lesion of the genital organs can be found to account for the pelvic pain, i.e., functional dysmenorrhœa.

Group B. Those cases with slight pathological processes in the pelvis which do not react favorably to ordinary gynecological treatment, i.e. sclerocystic degeneration of the ovaries; persistent pelvic pain following some previous operation.

Group C. Those cases in which the pathological lesion is known but which has been found to be too extensive for surgical removal, i.e., inoperable neoplasms in the pelvis giving rise to severe pain.

Group A. The functional type of dysmenorrhœa characterized by severe crises of pain immediately preceding or during the menstrual period that resist the ordinary gynecological therapeutics have been found to react most favorably to the operations upon the pelvic sympathetic nerves. Cotte (1929) has given the name "plexalgia" to that type of functional dysmenorrhœa in which the pain is primarily localized to the uterus but which radiates to the anus, coccyx, and urinary bladder, the regions corresponding to the distribution of fibers from the superior hypogastric plexus. The type in which the pain radiates to the lumbar and obturator regions is usually due to disturbances of the ovarian sympathetic plexuses. The group of functional dysmenorrhœa which reacts favorably to pelvic sympathectomy also includes those cases of genital hyperexcitability which have crises of hydrorrhœa and congestion of the pelvic organs accompanied by severe pain.

Group B. The great majority of cases naturally fall into this group, for it is comparatively rare to find true functional dysmenorrhœa without the slightest demonstrable pathological lesion or anatomical abnormality of the internal genital organs. It is, of course, very difficult to determine the exact rôle played by a mobile retroversion of the uterus or slight sclerocystic degeneration of the ovaries in the production of severe pelvic pain. Since the pelvic pain frequently persists after the retroversion of the uterus has been corrected or after the sclerocystic ovary has been removed, one can be quite certain that these minor lesions were not responsible for all of the pelvic pain. Then, too, one frequently finds sclerocystic degeneration of the ovaries or a mobile retroversion of the uterus in women who have never had dysmenorrhœa or pelvic pain. The recent work of Lhermitte and Dupont and of Roux suggests that there is a definite lesion of the sympathetic nerves in the ovaries to account for the pelvic pain in certain cases of sclerocystic degeneration of those organs. They have been able to demonstrate perifasicular and intrafasicular sclerosis of the sympathetic nerves with frequent neuroma formation (Fig. 8). These lesions of the nerves were so marked in many of the cases that these authors have suggested that sclerocystic degeneration of the ovaries is the result of such pathological processes in the sympathetic nerves. At present it is impossible to say if that is true or not but from the recent work of Professor Leriche we have learned that neuromata of the sympathetic nerves as well as of the spinal nerves have the ability of producing marked vasomotor disturbances that give rise to crises of severe pain. For this reason we are inclined to attribute more importance to the neuromata in the ovaries especially in relation to the symptomology associated with sclerocystic degeneration of the ovaries. Undoubtedly, some of the good influence of pelvic sympathectomy in such conditions can be explained on the basis of modification of the vascularization and secretion of the internal genital organs as has recently been shown experimentally by Chianello (1930); however, we believe that the interruption of the ascending pathways of many pathological reflexes from these organs is equally important.

In all cases of mobile retroversion of the uterus or slight sclerocystic degeneration of the ovaries, proper medical and non-operative gynecological treatment should always be given a fair trial. If, after a reasonable length of time, there is no improvement in the subjective symptoms the question of operative interference should be considered. It is well known that the palliative operations, such as, partial resection of an ovary or an unilateral oophorectomy, frequently give no relief from the pain in the pelvis in cases of sclerocystic degeneration of the ovaries. The patient is usually subjected to a second or third palliative operation without lasting benefit. Finally, a total hysterectomy is performed when the patient is still in her early thirties. All of this surgery has been done as treatment of a symptom complex which, originally at least, was only the result of some functional derangement of the pelvic sympathetic nerves. This type of patient is usually completely relieved of the pelvic pain by simple section of the superior hypogastric plexus without the sacrifice of any of the internal genital organs and without influencing the subsequent marriage and ability of bearing children of that young woman.

The real value of the pelvic sympathectomy has been established by the exhaustive work of Cotte and Michon. In cases in which there are definite anatomical lesions present which might account for part of the pelvic pain, we do not advise the section of the superior hypogastric plexus as the sole therapeutic procedure. We believe that at the time of the laparotomy the retroverted uterus should be suspended in the normal position and the cystic portion of the ovary removed, but the pelvic sympathectomy should be the most important part of the operation. The objection that one cannot determine exactly which of the procedures actually relieved the pelvic pain will always be brought up. Cotte has worked out his statistics very carefully, and in over 200 cases in which pelvic sympathectomy was combined with the other procedures his results were far superior to those

which he obtained in an equally large series of cases in which only the ordinary gynecological procedures were done. The reports of Michon as well as our own experience show that, in properly selected cases of functional dysmenorrhœa, complete and lasting relief follows the simple section of the superior hypogastric plexus.

Group C. The severe pain associated with inoperable neoplasms in the pelvis or, more rarely, due to the sclerosis in the pelvis following intensive radiation by radium or deep X-ray therapy should be treated surgically in spite of the fact that there is no hope for an operative cure of the neoplasm. Numerous procedures have been proposed for the relief of pain under such circumstances but most of them have failed to give uniformly satisfactory results. If the surgeon performs an extensive sympathectomy within the abdominal cavity he has an opportunity of verifying the pathological lesion, determine its extent and occasionally find the cause for the extreme pain. Professor Leriche was the first to show that the mechanism of the production of pain was not the same in all cases. In one case he simply removed a pyosalpynx which had developed as a result of the intensive deep X-ray therapy and which had become adherent to the common iliac artery. The pain disappeared completely after the removal of this inflammatory mass from the artery. Another patient showed typical root radiation of the pain, consequently she was completely relieved of the pain after section of the corresponding posterior root. In all cases in which there is no metastasis to the vertebræ and no typical root radiation of the pain, we believe that it is advisable to verify the extent of the neoplasm and, if possible, determine the cause for the severe pain, and then perform the complete sympathectomy. Ferey (1927) has suggested the removal of the superior hypogastric plexus in every case in which a hysterectomy is performed for carcinoma of the uterus as a prophylaxis against the pain in case there is a recurrence of the carcinoma. At present it is difficult to say if such a suggestion has any real therapeutic value.

II. *Types of operations employed.* There are four main types of sympathectomies that may be employed in the treatment of the various painful disturbances in the female pelvis. They are as follows:

A. Section of the superior hypogastric plexus (presacral nerve).

B. Section of the ovarian nerves.

C. Peri-arterial sympathectomy of the internal iliac artery.

D. Section or removal of the lower part of the lumbar sympathetic chain of one or both sides.

A. The section of the superior hypogastric plexus may be performed anywhere along its course from the inferior mesenteric ganglion to the point just below the promontory of the sacrum where it joins the inferior hypogastric plexus (Fig. 3). The plexus is easily accessible at the level of the bifurcation of the aorta where it is situated just beneath the peritoneum. It is at this level that one resects a segment of the plexus about 1 inch long in performing the superior hypogastric sympathectomy (Fig. 9).

B. The denervation of the ovaries according to the method of Lhermitte and Dupont (1926) consists of the isolation and resection of the nerves in the utero-ovarian ligaments. The operation is quite difficult to perform and one can never be certain that all of the nerve fibers have been severed. From the clinical standpoint, it is sometimes impossible to differentiate between the pelvic pain due to disturbances in the ovaries and that due to disturbances in the superior hypogastric plexus. We feel that section of the superior hypogastric plexus should be the operation of choice for the relief of pelvic plexalgias.

C. The peri-arterial sympathectomy of the internal iliac artery was the first operation upon the pelvic sympathetic nerves which gave complete and lasting relief from the pain of functional dysmenorrhœa or hypogastric plexalgia. Professor Leriche has reported several cases that have had complete relief for over 6 years. The section of the superior hypogastric plexus (presacral nerve) as originally proposed by Cotte (1925) proved to be much simpler from the technical standpoint and the final results were just as good; therefore, the former operation is no longer used for the relief of the pelvic pain of hypogastric

plexalgia. In cases of trophic disturbances of the external genital organs, especially kraurosis vulvæ, only the peri-arterial sympathectomy of the internal iliac artery is indicated, since the nerve fibers to the vulva do not pass through the superior hypogastric plexus.

D. The section or removal of the lower part of the lumbar sympathetic chain on one or both sides should be used as an adjunct to other pelvic sympathectomies. In cases of inoperable carcinoma or sarcoma in the pelvis, in which the neoplasm has invaded into all the pelvic organs, a very complete pelvic sympathectomy must be done in order to relieve the patient of all the pain. We believe that in all such cases the sectioning of the superior hypogastric plexus and the removal of the pre-aortic plexus as high as the origin of the inferior mesenteric artery should be done in addition to the resection of the lower part of both lumbar sympathetic chains. Lumbar ramisection or extirpation of the lumbar sympathetic ganglia have been shown by Leriche (1924), Hunter (1924), Royle (1924), Adson and Brown (1925), Wade (1927), and many others to be of great benefit in other diseases but those indications cannot be discussed at this time.

III. *General review of results obtained.* Prior to 1925, all cases of functional dysmenorrhœa or hypogastric plexalgia that did not respond to the usual gynecological treatment were treated by periarterial sympathectomy of the internal iliac or common iliac arteries. The results published by Leriche (1925), Hallopeau (1922), Cotte (1925), Michon (1926), and Bittmann (1925) show that this operation gave complete and lasting relief in the great majority of the cases. After 1925, however, the simpler method of the resection of the superior hypogastric plexus (presacral nerve), which was introduced by Cotte, became the common operation for this type of pelvic pain. In 1927, Cotte reported 90 patients in which the section of the presacral nerve was performed for functional dysmenorrhœa and hypogastric plexalgia. The great majority of these patients were completely relieved of the pelvic pain. In 1929, he reported 200 patients in which very satisfactory results were likewise obtained. Michon reported a series of 22 patients in which pelvic sympathectomy (section of the presacral nerve, peri-arterial sympathectomy of the internal iliac artery or sacral ramisection) was followed by complete relief of all subjective symptoms. In 1926, Ferey published his first 10 cases, and in 1929 he added 40 new cases. Of these 50 cases he states that 47 per cent of them were completely relieved of all pelvic pain; 45 per cent were reported as greatly improved, and only 8 per cent were reported as having received no benefit from the pelvic sympathectomy. Hamant (1926) reported 18 cases in which pelvic sympathectomy gave excellent therapeutic results. Walther (1929) basing his opinion on 14 cases states that section of the presacral nerve is also indicated in cases of chronic painful salpingitis and chronic metritis when thorough medical and gynecological treatment fail to relieve the pelvic pain. He states that the sympathectomy gives better results than the more radical gynecological operations of salpingectomy or hysterectomy. He also believes that the sympathectomy should be done in connection with all conservative operations in the pelvis, such as fixation of the uterus or resection of one fallopian tube when pelvic pain is an outstanding pre-operative symptom. Cueille (1929) reported 12 patients who were completely relieved of the pelvic pain after the resection of the superior hypogastric plexus. These results have been confirmed by the reports of Tisserand (1925), Bonnet (1927), Costantini and Schebat (1928), and many others.

Pelvic sympathectomy has also been widely practiced outside of France. In Roumania, Gomoiu (1920), Georgesco (1926) and Jianu (1928) have reported great success in a large series of cases. In Spain Soler-Julia (1928) reported excellent results with this form of therapy. Pereira (1929) in Portugal, Fabião (1928) in Brazil and Rophille (1926) in Argentine have also reported great success in treating the rebellious types of dysmenorrhœa and hypogastric plexalgia by sectioning the presacral nerve. In Switzerland, Aubert (1929) reported 14 cases with very satisfactory results from the pelvic sympathectomy. In Italy, Pieri (1926), Micheli (1927), Tirelli

(1928), Paolucci (1928), and Spirito (1928) have applied the pelvic sympathectomy in a large series of cases and they all have reported very favorable results. In 1929, de Grisogno reported a series of 35 cases in which resection of the presacral nerve was done for the relief of severe pelvic pain. An excellent therapeutic result was obtained in all cases. In Poland, Dziembowski (1930) was the first to apply this method in the treatment of rebellious types of dysmenorrhœa. Ekkert Petersen (1930) reported 9 cases in which resection of the presacral nerve gave complete relief of all pelvic pain.

In the clinic of Professor Leriche during the period from January 1, 1925, to August 15, 1930, the operation of resection of the superior hypogastric plexus (presacral nerve) was performed on 22 young women suffering from some form of severe pelvic pain. In one case (Case 18) only the resection of the superior hypogastric plexus was done. In all the other cases the associated anatomical derangement or slight pathological lesions were corrected at the same operation. The following abstracts of case records will serve to show the results which we have obtained.

EFFECTS OF THE REMOVAL OF THE SUPERIOR HYPOGASTRIC PLEXUS IN PATIENTS WITH FUNCTIONAL DYSMENORRHŒA AND HYPOGASTRIC PLEXALGIA

CASE 1. The patient was an unmarried woman, aged 18 years, who was referred to the hospital because of severe dysmenorrhœa and occasional attacks of pain in the right lower quadrant of the abdomen. No nausea or vomiting was associated with the pain in the abdomen. Her menstrual periods began when she was 14 years of age. They have always been regular but extremely painful. Pain is most marked at the onset of the period. The periods last about 3 days and recur regularly every 28 days. There is a moderate flow. No improvement was noticed in the pain after intensive medical and ordinary gynecological therapy. Pelvic examination revealed the uterus to be in slight retroversion. Laparotomy was performed on January 6, 1927. The uterus was found in second degree of retroversion, and both ovaries showed a moderate amount of sclerocystic degeneration. The superior hypogastric plexus was resected for a distance of about 1 inch. The uterus was suspended in the normal position according to the method of Doléris. The appendix was found to be normal but it was removed in the routine manner. Three days after the operation the regular menstrual period appeared but was entirely without pain or discomfort. Repeated follow-up examinations have shown that the menstrual periods have remained painless, moderate in amount, regular, and each period lasted about 4 days. No urinary disturbances were noted. Bowel movements have remained regular. Follow-up note in February, 1931, shows that the patient is still absolutely free from pain or discomfort over 4 years after the operation.

CASE 2. The patient was a married woman, aged 30 years, who was sent to the hospital because of marked pain in the lower part of the abdomen and irregular, painful menstrual periods. Her menstrual periods began when she was about 13 years of age and were always regular and painless until a few years ago. Because of the fact that the menstrual periods became extremely painful, she sought the advice of her family physician. After an examination, she was told that a pelvic operation was necessary. This operation was done and it is reported that one cystic ovary was removed. The pains were not relieved by this operation. About 1 year later she was referred to the clinic of Professor Leriche. Pelvic examination showed the uterus to be fixed. No abnormal masses were palpable in the pelvis. Laparotomy was performed on October 14, 1925. Many adhesions were found in the pelvis. Some of the adhesions were freed and the superior hypogastric plexus was isolated and a section about 1 inch long was resected. The pains in the pelvis disappeared for several months. In February, 1926, the patient returned to the clinic because of a recurrence of all of her former symptoms. At this time a subtotal hysterectomy was performed. The sympathectomy in this case produced no lasting benefit to the patient.

CASE 3. The patient was a married woman, aged 21 years, who entered the hospital because of marked pain associated with her menstrual periods. Her menses began when she was 14 years of age and they had always been slightly irregular and moderately painful, with a moderate flow that lasted about 6 days. In January, 1926, she began to have marked pain in the lower left quadrant of the abdomen accompanied by a profuse leucorrhœal discharge. The pains were always much more severe just before the onset of her menstrual period. At the time of admission to the hospital, there was no vaginal discharge but the severe dysmenorrhœa remained the same. Medical treatment failed to give any relief. Vaginal examination was normal. Laparotomy was performed on July 29, 1927. The uterus was found in the first degree of retroversion but the adnexal regions appeared normal. In view of the severity of the pain and the apparent radiation to all of the pelvic viscera, Professor Leriche felt that the sympathectomy should be more extensive. He therefore performed a periarterial sympathectomy of the left common iliac artery in addition to the removal of the superior hypogastric plexus. The retroverted uterus was suspended in the

normal position. The immediate postoperative course was uneventful. On the second postoperative day a moderate amount of bloody discharge from the vagina was noticed. This supplementary menstrual period was without pain or discomfort. The next regular menstrual period appeared on the scheduled day and was not accompanied by the usual pain. The patient left the city a few weeks later so we have been unable to obtain any further follow-up data concerning the ultimate result of the operation.

CASE 4. The patient was a young, unmarried woman, aged 24 years, who was referred to the hospital on March 20, 1927, with a diagnosis of chronic appendicitis. On careful questioning of the patient it was found that the abdominal pain was formerly present only during her menstrual periods but that during the past 5 weeks the pains have been lancinating in character and radiate to the lumbar region and to the right side of the abdomen. Her menses began when she was about 14 years of age and remained regular and only slightly painful until she was about 19 years of age. Since that time the periods have become increasingly more painful and more profuse. The pains have been particularly violent on the second day of the menstrual period. Physical examination of the abdomen showed moderate tenderness over McBurney's point but no muscle spasm. Pelvic examination revealed tenderness in the right side of the cul-de-sac. The uterus was in second degree retroversion. Laparotomy was performed on April 2, 1927. The uterus was found to be in retroversion but the adnexa were free. The right ovary showed marked cystic degeneration. The superior hypogastric plexus was isolated, and a portion about 1 inch long was resected. The uterus was suspended in the normal position. The appendix, which appeared normal, was removed in the routine manner. On the first postoperative day the temperature of the patient rose to 39 degrees C. The patient became very restless and the pulse became rapid and thready in character. The abdomen remained soft and the patient did not vomit. The lungs were normal by physical examination. The heart was not enlarged and there were no murmurs. The rate was very rapid but regular. The patient died on the second postoperative day. Autopsy revealed a marked œdema of the brain. The abdominal, pelvic, and thoracic viscera were normal.

CASE 5. The patient was a young unmarried woman, aged 20 years, who was referred to the hospital because of severe and almost constant pains in the lower part of her abdomen. In December, 1926, she was operated upon because of nephroptosis, and a transperitoneal nephrectomy was performed. A few months after this operation, the patient began to have severe sharp pains in the lower part of the abdomen and in the pelvis. The pains have gradually increased in severity, and all palliative methods have failed to relieve the intense suffering of the patient. The radiation of the pains to the lower part of the lumbar region suggested that relief might be obtained by resection of the superior hypogastric plexus. Laparotomy was performed on March 24, 1927. After freeing numerous dense adhesions the superior hypogastric plexus was isolated and a portion about 1 inch long was resected in the usual manner. The postoperative course was uneventful. The patient was completely relieved of the severe sharp pains in the pelvis but still had occasional attacks of dull pain in the lower part of the abdomen. At the time of discharge from the hospital, the patient was practically free from the former pelvic pain and she was quite comfortable and active throughout the entire day. The patient failed to return for further follow-up examination.

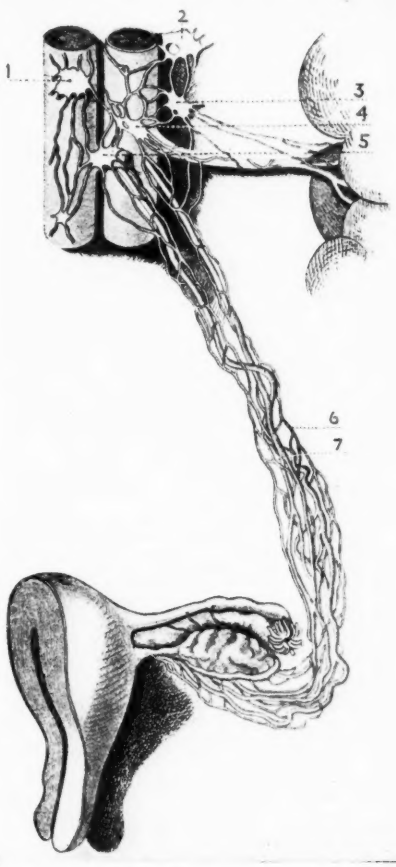

Fig. 1. The innervation of the ovary. *1*, Superior mesenteric ganglion; *2*, cœliac plexus; *3*, first renal ganglion; *4*, second renal ganglion; *5*, spermatic ganglion; *6*, spermatic plexus; *7*, ovarian plexus. (After Dahl.)

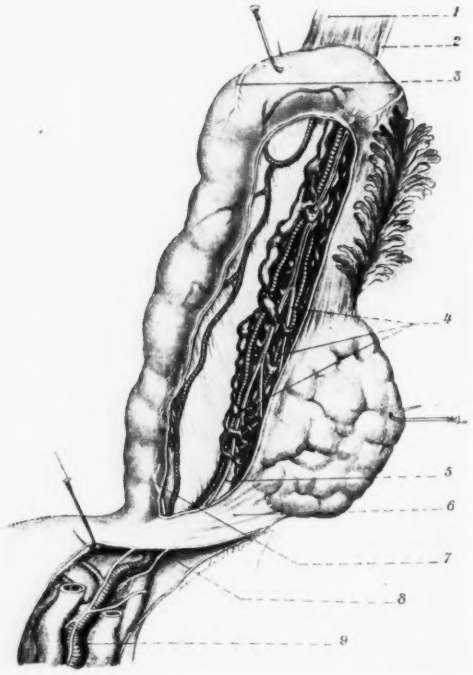

Fig. 2. Detailed anatomy of the nerves of the ovary. *1*, Suspensory ligament of the ovary; *2*, ovarian nerve; *3*, external tubular branch; *4*, ovarian plexus; *5*, filament to lateral border of uterus; *6*, utero-ovarian ligament; *7*, tubular branch from lateral uterine plexus; *8*, uterine branch from ovarian plexus; *9*, lateral uterine artery. (After Hovelacque.)

CASE 6. The patient was a married woman, aged 35 years, who entered the hospital because of severe pains associated with her menstrual periods. Her menses have always been slightly irregular and moderately painful. During the past few years the pain has become progressively worse and recently she has been compelled to go to bed during the first part of each menstrual period. Flow is moderate in amount. There is no pain between the menstrual periods. She had been treated medically for several months without benefit. Pelvic examination was normal. Laparotomy was performed on April 2, 1929. The uterus was found to be in a slight degree of retroversion. The left ovary showed extensive cystic degeneration, and it was therefore removed. The ovarian veins were very tortuous and enlarged. The superior hypogastric plexus was isolated and a portion about 2 inches long was resected. The uterus was suspended in the normal position. The patient made an uneventful recovery. The supplementary menstrual period, which appeared 2 days after the operation, was without pain or discomfort. At the time of discharge from the hospital, the patient was entirely free from her former symptoms. She failed to return for further follow-up examinations; consequently we have no data concerning the final result of the operation in this case.

CASE 7. The patient was a married woman, aged 25 years, who was referred to the hospital because of marked dysmenorrhœa. Her menses began when she was 14 years of age and were always regular. She has always had severe cramp-like pains in the lower part of the abdomen immediately before the onset of the menstrual period and a great deal of aching pain in the lower lumbar region throughout the entire menstrual period. About 2 months prior to her entrance into the hospital she developed a severe pain of a sharp stabbing nature in the right lower quadrant of the abdomen. The pains radiated to the sacro-iliac region and were greatly exaggerated by walking. No nausea or vomiting was associated with this pain. A diagnosis of chronic appendicitis was made by her attending physician. At the time of entry into the hospital on January 10, 1928, the entire physical examination was normal. Cholecystograms showed a normal functioning gall bladder. The gastro-intestinal X-ray studies were essentially normal. Vaginal examination revealed the uterus to be in the posterior position but it could easily be brought up into the normal position. In the right side of the cul-de-sac, a slightly enlarged ovary could easily be palpated. Slight pressure on this ovary caused the patient great pain. Laparotomy was performed on January 21, 1928. A small, para-ovarian cyst was found on each side. Both ovaries showed marked cystic degeneration. The right ovary was slightly adherent in the cul-de-sac. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected in the usual manner. Macroscopically the appendix appeared normal but it was removed as a routine procedure. The supplementary menstrual period appeared on the day following the operation. The next regular menstrual period appeared on January 27, just 28 days after the last normal period but entirely without pain or discomfort. During the past 2½ years the patient has been seen several times and her menstrual periods have continued to be regular and painless. The flow is slightly greater than it was before the operation, but at present the periods last only 3 days instead of the pre-operative duration of 6 to 7 days. She has gained slightly in weight. She has had no urinary disturbances and her bowel movements have remained regular.

CASE 8. The patient was a married woman, aged 39 years, who was referred to the hospital because of dysmenorrhœa and an inability to become pregnant after 6 years of married life. Her menses were usually regular, but occasionally there was an interval of about 6 weeks between the periods. She had had moderately severe pains in the lower lumbar region and in the lower part of the abdomen during the first part of each menstrual period. Last menstrual period ended 1 week prior to her admission

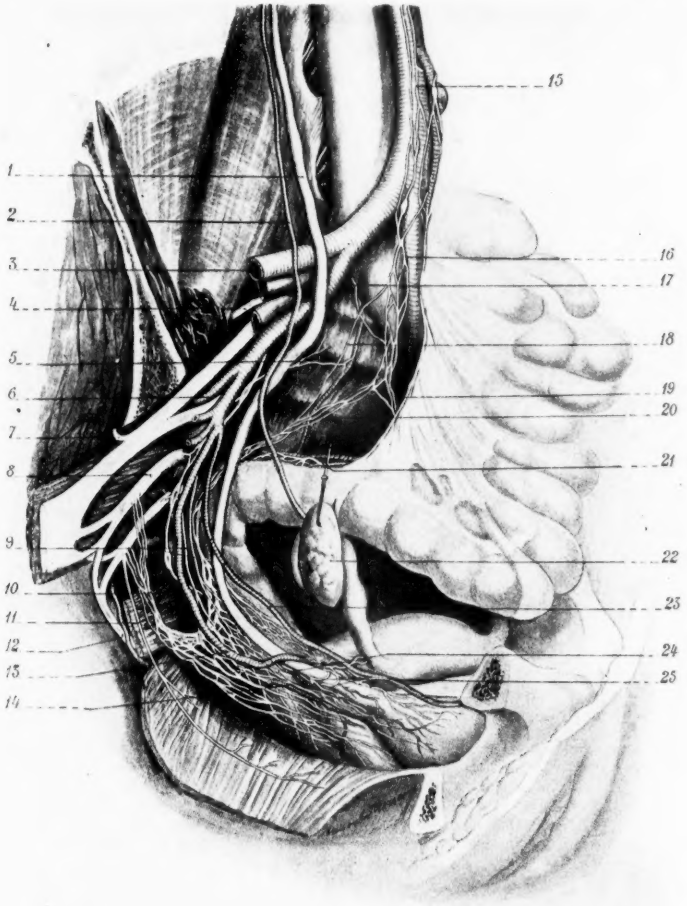

Fig. 3. The hypogastric plexus in the female. *1*, Ureter; *2*, ovarian artery; *3*, external iliac artery; *4*, obturator nerve; *5*, branches from the sacral sympathetic chain; *6*, superior gluteal artery; *7*, superior gluteal nerve; *8*, anterior branch of second sacral nerve; *9*, sympathetic fibers to inferior hypogastric plexus; *10*, secondary branches of hypogastric plexus; *11*, nerve to the levator ani muscle; *12*, pudic nerve; *13*, uterine artery; *14*, long vaginal artery; *15*, intermesenteric nerves of right side; *16*, superior hypogastric plexus; *17*, fibers from fifth lumbar sympathetic ganglion to superior hypogastric plexus; *18*, nerve fiber of superior hypogastric plexus; *19*, left inferior hypogastric plexus; *20*, right inferior hypogastric plexus; *21*, superior hæmorrhoidal plexus; *22*, ovary; *23*, right umbilical artery; *24*, vesicovaginal artery; *25*, peri-ureteral nerves. (After Hovelacque).

to the hospital (July 5, 1928). General physical examination was normal. Pelvic examination revealed a slight retroversion of the uterus. No abnormal masses were palpable in the adnexal regions. Laparotomy (Pfannenstiel incision) was performed on July 13, 1928. The uterus was found to be in acute retroflexion. The left fallopian tube and ovary were adherent posteriorly but they were freed without difficulty. The left ovary contained a dermoid cyst about the size of a walnut. The right ovary showed marked cystic degeneration. Partial resection of the right ovary was done, and the left

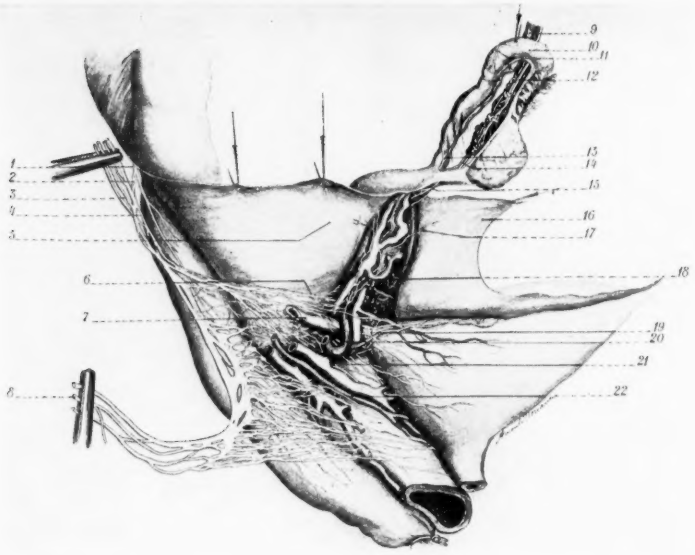

Fig. 4. The inferior hypogastric plexus in the female. *1*, Superior hæmorrhoidal plexus; *2*, anastomosis between the superior hæmorrhoidal plexus and inferior hypogastric plexus; *3*, posterior segment of inferior hypogastric plexus; *4*, branches to rectum; *5*, posterior layer of broad ligament; *6*, branches to uterus; *7*, ureter; *8*, secondary branches from pudendal plexus; *9*, ovarian plexus; *10*, fallopian tube; *11*, external tubular branch of ovarian plexus; *12*, nerves to ovary; 13, tubular branch from uterine plexus; *14–15*, uterine branches from ovarian plexus; *16*, anterior layer of broad ligament; *17*, filament to peritoneum; *18*, lateral uterine plexus; *19*, peri-ureteral nerves; *20*, nerve filament along uterine artery; *21*, uterine artery; *22*, long vaginal artery. (After Hovelacque.)

ovary was removed. Four large nerve trunks of the superior hypogastric plexus were resected for a distance of about 2 inches. The uterus was suspended in the normal position. The postoperative course was normal. On the first postoperative day a moderate serosanguineous discharge from the vagina was noticed. There was no pain associated with that supplementary period. At the time of discharge from the hospital about 3 weeks after the operation the patient was entirely free from pain or discomfort. A short time later she returned to her home in Poland, and we have been unable to obtain any further follow-up data concerning the result of the operation.

Case 9. This patient was an unmarried woman, aged 26 years, who was referred to the hospital because of very severe dysmenorrhœa. Her menses began when she was 16 years of age and have always been very painful, profuse, and irregular. They had been appearing every 2 to 3 weeks and the flow usually lasted for 8 days. Two or 3 days before the onset of the period, the patient would have a violent headache followed by an attack of vomiting. Vaginal examination revealed nothing abnormal. Laparotomy was performed on September 8, 1928. The uterus was freely movable and in good position. The appendix appeared normal but it was removed as a routine procedure. The superior hypogastric plexus was isolated and resected in the usual manner. On the day following the operation the supplementary period appeared but it was entirely painless. The patient was completely relieved of the pelvic pain for several months after which the pains gradually returned and at the last follow-up examination in August, 1930, the patient stated that the pains were practically as severe as they were before the operation. The sympathectomy, therefore, had no lasting beneficial effect in this case.

Case 10. This patient was an unmarried woman, aged 42 years, who entered the hospital because of severe pains in the lower part of her abdomen. These pains were usually much more severe during the first 2 days of each menstrual period. Her menses began when she was 17 years of age and have always been regular. She has one child 5 years of age. Since the birth of her child the pains in the lower part of her abdomen have been constantly present. She

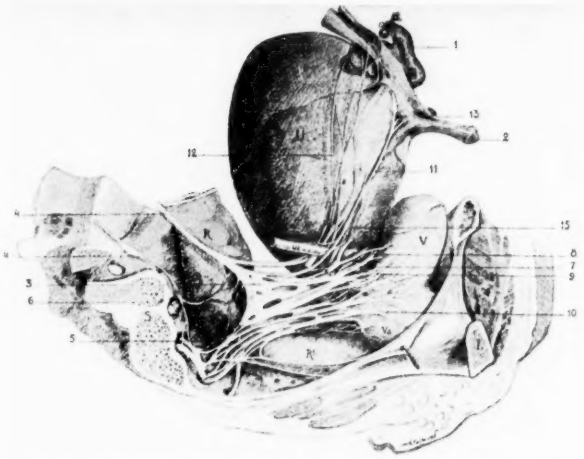

Fig. 5. The hypogastric ganglion and its branches in the female. (Dissection made on a woman who died 8 days after delivery.) *1*, Fallopian tube; *2*, round ligament; *3*, hypogastric ganglion; *4*, hypogastric nerve; *5*, sacral anastomoses; *6*, nerves to rectum; *7*, external ureteral nerve; *8*, peri-ureteral plexus; *9*, nerves to urinary bladder; *10*, nerves to vagina; *11*, lateral nerve of uterus; *12*, tubular branches from nerves in broad ligament; *13*, plexus of nerves at base of round ligament; *14*, lumbar sympathetic chain; *15*, uterine artery; *U*, uterus; *Va*, vagina; *V*, urinary bladder; *RR'*, rectum; *P*, pubis; *I*, ischium; *S*, sacrum. (After Latarjet and Rochet).

vomits frequently and is markedly constipated. Leucorrhœa is profuse and there is occasional incontinence of urine when she is in the standing position. Vaginal examination revealed the uterus to be slightly enlarged and the cervix bilaterally lacerated. There was some tenderness in both adnexal regions. Laparotomy (Pfannenstiel incision) was performed on November 18, 1928. The uterus and adnexa were free. There was a small subserous fibroma on the postero-inferior surface of the uterus. Both ovaries showed moderate cystic degeneration. The small fibroma and the vermiform appendix were removed. The presacral nerve was sectioned. The supplementary menstrual flow appeared on the second postoperative day but it was painless. At the time of discharge from the hospital, the patient was entirely free from the pain in the lower part of the abdomen and pelvis. She did not return for further follow-up examinations.

CASE 11. This patient was an unmarried woman, aged 19 years, who entered the hospital because of severe lower abdominal pain associated with her menstrual periods. Her menses began when she was 12 years of age and were regular and painless until she was about 15 years of age. Since that time she has had an increasing amount of pain with each menstrual period, so during the few months prior to her admission to the hospital it was necessary for her to go to bed during the first 3 days of each period. The periods last from 10 to 12 days and are most painful on the second and third days. The general physical examination was negative. Vaginal examination showed the adnexa to be free and the uterus in a slight degree of retroversion. Laparotomy was done on November 29, 1928. Both ovaries showed moderate cystic degeneration. The uterus was suspended in the normal position. The appendix was removed. The presacral nerve was sectioned in the usual manner. On the second postoperative day, the supplementary period appeared, without the slightest pain or discomfort. She was discharged

Fig. 6. Sagittal section through the uterosacral ligament showing the nerve fibers between the two peritoneal surfaces. (After Latarjet and Rochet).

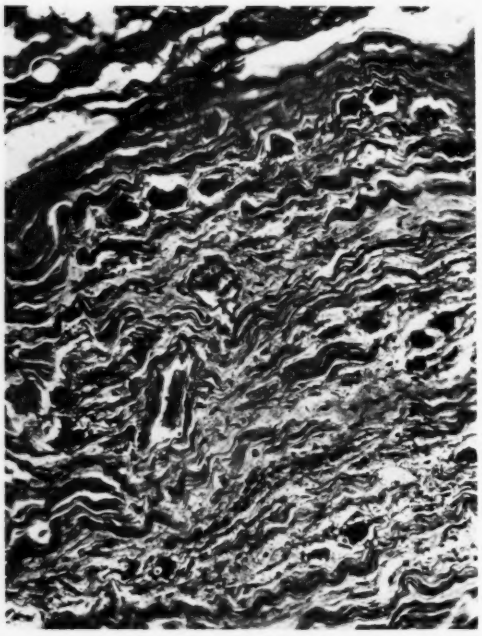

Fig. 7. Photomicrograph showing numerous ganglion cells interposed between the nerve fibers of the preaortic plexus (del Rio Hortega stain) ×530.

from the hospital on the fourteenth postoperative day completely free from all abdominal or pelvic pain. The subsequent menstrual periods were regular, painless, and lasted only 3 to 4 days. In July, 1930, approximately 20 months after the operation she was still without pain during her menstrual periods. Her general health was excellent and she has gained slightly in weight. She has had no sphincteric disturbances. At the end of August, 1930, we learned that she was several months' pregnant and that the pregnancy was progressing normally.

Case 12. This patient was a young unmarried woman, aged 17 years, who entered the hospital because of marked lower abdominal pains associated with her menstrual periods. Her menses began when she was about 14 years of age. They had always been irregular, profuse, and usually lasted about 1 week. Severe cramp-like pains radiating to the right iliac fossa always accompanied the menses. Because of the fact that the patient vomited frequently during these attacks of pain, she was sent to the hospital with a diagnosis of chronic appendicitis. There was never any tenderness or muscle spasm in the right lower quadrant of the abdomen associated with the pelvic pain. Pelvic examination revealed the uterus to be in the second degree of retroversion. No tenderness and no masses were found in the adnexal regions. Laparotomy was performed on November 18, 1929. The uterus was in the retroverted position, but it was freely movable, and it could be brought into the normal position easily. The adnexa were free but both ovaries showed considerable cystic degeneration. The superior hypogastric plexus was resected in the usual manner. The uterus was suspended in the normal position. Macroscopically the appendix appeared normal but it was removed in the routine manner. The patient made an uneventful postoperative recovery. At the time of discharge from the hospital she was entirely free from all the former symptoms and she had no trouble with micturition or defæcation. She failed to return for further follow-up examinations.

Case 13. This patient was a young married woman, aged 27 years, who was referred to the hospital because of severe abdominal and lumbar pains associated with her menstrual periods. The pains were so severe that she was obliged to go to bed for the first 2 days of each menstrual period. Menses began when she was 15 years of age and were always slightly irregular, painful, and moderately profuse. She has never been pregnant. She gave no history of venereal diseases. Pelvic examination revealed the uterus to be freely movable and the adnexa normal. Laparotomy (Pfannenstiel incision) was performed on April 5, 1929. The uterus was in second degree retroversion. The superior hypogastric plexus was resected in the routine manner. The uterus was suspended in normal position according to the method of Doléris. The vermiform appendix was atrophic. It was removed in the usual way. The postoperative course was uneventful. All subjective symptoms disappeared after the operation and the menstrual periods have become regular and less profuse. Follow-up examination in September, 1930, 1½ years after the operation, showed the patient to be in excellent health and entirely free from pain or discomfort during her menstrual periods.

Case 14. This patient was a married woman, aged 36 years, who came to the hospital because of severe pelvic pain associated with her menstrual periods. Menses began when she was about 14 years of age. They have always been regular, profuse, and of 7 to 8 days' duration. She had always had moderately severe pains preceding and during the first part of each menstrual period. She has been married for 12 years but she has never been pregnant. During the past 4 years the pains in the pelvis have gradually become more intense with each succeeding menstrual period. During the 6 months prior to her admission to the hospital, the pelvic pain was so severe that she was obliged to remain in bed throughout the entire duration of the menstrual period. The pains were described as originating deep in the pelvis and radiating anteriorly toward the uterus and down the medial aspect of both thighs toward the knees. She has never had pain in the lumbar region. Intensive

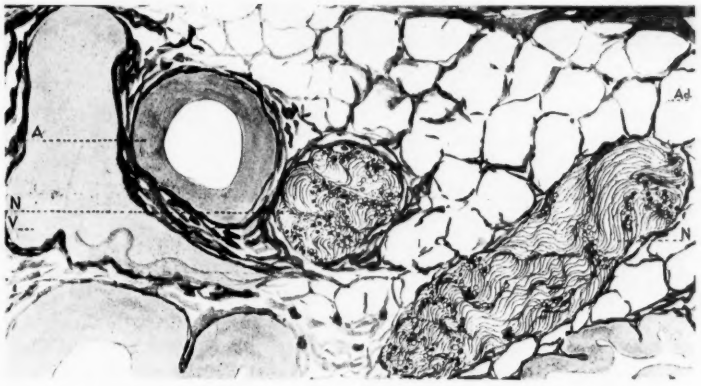

Fig. 8. Neuromata in the pedicle of an ovary which showed marked sclerocystic degeneration (Mallory stain). *N*, Neuromata; *V*, vein; *A*, artery; *Ad*, adipose tissue. (After Roux).

medical and gynecological treatment has failed to give relief. During the 2 months prior to admission to the hospital, the menstrual periods lasted about 10 days, but the pelvic pain began about 1 week before the period and continued for 8 days after the cessation of the menstrual flow. She has become very constipated but has had no urinary disturbances and no leucorrhœa. In 1926, while the patient was in Montreal she developed severe sharp pains in the right side of the abdomen. The history suggested cholelithiasis. Intensive medical treatment failed to give any relief from the attacks of pain. After about 4 months of such crises of pain she was submitted to a laparotomy. The gall bladder was found to be normal. The vermiform appendix, however, was found to be very adherent to the iliac fossa. Histological studies of this appendix by Professor Masson revealed the presence of many neuromata. Following the removal of this appendix the pains in the right iliac fossa disappeared completely but the dysmenorrhœa persisted in a somewhat milder form. She was referred to Professor Leriche in October, 1929, because of the dysmenorrhœa. Laparotomy was performed on October 17, 1929 (Pfannenstiel incision). The uterus was in second degree retroversion. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected. The uterus was suspended according to the method of Doléris. The postoperative course was uneventful. She was discharged from the hospital on the twelfth postoperative day entirely free from abdominal pain. Follow-up examination was made on August 30, 1930. Her general health was excellent, she had gained 12 pounds in weight, and was much less constipated. She stated that she no longer had pains before, during, or after her menstrual periods. The menses were regular, about 4 days in duration, but the flow was still quite profuse. She stated that she had been transformed into a new individual since the last operation. In February, 1931, 16 months after the operation, the patient was still free from abdominal or pelvic pain and in an excellent state of health.

Case 15. This patient was a young married woman, aged 27 years, who was referred to the hospital with a diagnosis of chronic appendicitis. She had always been well and active until 1925 when she began having crises of lower abdominal pain. The pains usually remained in the lower part of the abdomen but occasionally radiated to the umbilicus. The crises of pain were usually associated with vomiting. Gradually the crises became more and more frequent until finally only a few days intervened between them. The pains have always been much more severe during or immediately before the menstrual period. The patient was treated medically for several months without beneficial results. Menses have always been regular. Recently they have become extremely painful and accompanied by incessant vomiting. General physical examination was negative. Gastro-intestinal X-ray studies showed no definite pathological lesion. Vaginal examination revealed the uterus in slight retroversion and the right ovary to be large and tender. Laparotomy (Pfannenstiel incision) was performed on December 13, 1929. Both ovaries were free but they showed marked cystic degeneration. The uterus was in second degree retroversion. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected. The retrodisplacement of the uterus was corrected by the Doléris procedure. The appendix, which appeared normal, was removed. The postoperative course was uneventful. The patient was discharged on the eighteenth postoperative day. She was entirely free from abdominal or pelvic pain. Follow-up examination on July 10, 1930, showed the patient to be in an excellent state of health. She had gained

Fig. 9. The general topography of the lumbar area showing the relation of the superior hypogastric plexus (presacral nerve) to the bifurcation of the aorta and the common iliac vessels. The patient is in the Trendelenburg position.

16 pounds since the operation. She had not vomited since the operation, and her menstrual periods had become regular, painless, moderately profuse, but usually of only a few days' duration. She had no disturbances of micturition or defæcation. She has had 8 months of complete relief from pelvic and abdominal pains.

CASE 16. This patient was a young unmarried woman, aged 25 years, who was referred to the hospital because of severe lower abdominal pains associated with her menstrual periods. Menses have always been irregular and the flow has always been profuse. She has always had considerable pain in the lower lumbar region immediately preceding and usually during the first part of each menstrual period. Some time before admission to the hospital, a dilatation and curettage of the uterus was done, but the pelvic pain and menstrual disturbances were not improved by this operation. Pelvic examination revealed complete retroversion of the uterus. Laparotomy was performed on February 9, 1930. The uterus was in third degree retroversion. The adnexa were normal. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected. The retrodisplacement of the uterus was corrected by the procedure of Doléris. The appendix was removed. The postoperative course was uneventful. The patient was discharged from the hospital on the fourteenth postoperative day. She was entirely free from pelvic or abdominal pain. Follow-up examination in June, 1930, 4 months after the operation, showed that the menses had become regular, painless, and moderate in amount. The patient had been working regularly without the slightest amount of pelvic or abdominal pain at any time.

CASE 17. The patient was a married woman, aged 30 years, who was referred to the hospital because of dysmenorrhœa and vulvar pruritis. She had always been in good health. Menses began when she was 12 years of age and were always regular, profuse, and of about 5 days' duration. One child, aged 8 years, is living and well. One year prior to admission to the hospital she began to have aching pains in the lower part of the abdomen associated with marked leucorrhœa and pruritis of the vulva. There was no clinical or laboratory evidence of diabetes mellitus. During the past few months, the pains have localized in the right iliac fossa. Dyspareunia has been marked during the past 3 months. There is no burning on urination and no frequency of urination. Physical examination revealed marked tenderness over McBurney's point but without spasm of the abdominal muscles. Vaginal examination revealed a marked retrodisplacement of the uterus. No abnormal masses were palpable in the adnexal regions. Laparotomy was performed on April 25, 1930. The presacral nerve was isolated and resected in the usual manner. The uterus was suspended in the normal position. The appendix was removed. During the postoperative course, the patient developed a phlebitis of the left leg which delayed her recovery for several weeks. At the time of discharge from the hospital, however, she was entirely free from the abdominal pain and pruritis of the vulva. Follow-up examination in August, 1930, 4 months after the operation, showed the patient in very good health and entirely free from all of her former complaints.

CASE 18. This patient was a young girl, aged 15 years, who was referred to the hospital because of severe lower abdominal pains associated with irregular menstruation. About 1 year prior to admission to the hospital an appendicectomy was performed but that operation did not relieve the lower abdominal pain. Menses began when she was about 12 years of age and remained regular and painless until February, 1930, when complete cessation of the menses took place. She was treated medically by injections of ovarian extract but without influence on the amenorrhœa. The past history shows that the patient has had frequent attacks of severe pain in the left iliac fossa at varying intervals since she was about 5 years of age. These attacks of pain have recently become more frequent and decidedly more painful. No vomiting or disturbances of micturition was associated with the attacks of pain. Examination of the urinary system was negative. There was no evidence of renal or bladder calculi. Laparotomy (Pfannenstiel incision) was performed on May 6, 1930. The abdominal and pelvic viscera were normal. The uterus was in the normal position. Exploration failed to reveal any cause for the crises of pain. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected. The postoperative course was uneventful. She was discharged from the hospital on the fourteenth postoperative day. At about the scheduled time in June her menses reappeared without any associated abdominal pain. Menses have remained regular and painless. There were no urinary disturbances present until about the middle of July, 1930, 2½ months after the operation. At this time she returned to the clinic because of severe lower abdominal pain. Examination revealed a marked distention of the urinary bladder. Microscopical and chemical tests of the urine were all negative. The patient was catheterized regularly for 4 days after which normal micturition was again possible. She has been seen at regular intervals since that time, and there have been no further urinary disturbances. Menses continue to be regular and painless. The pain in the left iliac fossa has completely disappeared. Follow-up examination in January, 1931, showed the patient to be in excellent health. She has gained in weight and has remained entirely free from abdominal pain or further urinary disturbances.

CASE 19. This patient was an unmarried woman, aged 21 years, who was referred to the hospital because of severe lower abdominal pain which was accentuated at the time of her menstrual periods. Menses began when she was 15 years of age and were regular and only slightly painful until 4 years ago when she developed acute salpingitis. Since then she has had considerable dysmenorrhœa and frequent exacerbations of the salpingitis. On September 4, 1928, she gave birth to an apparently normal child. An exacerbation of the pelvic inflammatory disease began with the menstrual period about 3 weeks before admission to the hospital. On admission to the hospital (April 23, 1930) her temperature was 38.5 degrees C. and she complained constantly of pains in the lower part of the abdomen. Pelvic examination did not reveal any areas of induration or any abnormal masses. Pressure in the cul-de-sac caused intense pain in the pelvis and pains radiating to the lumbar region. Medical treatment with tampons and hot douches was continued until June 2. The temperature fell to normal on the third hospital day but the pain persisted in spite of the vigorous medical treatment. Because of the persistence of the intense pelvic pain the patient was submitted to an operation. On June 3, 1930, the abdomen was opened through a Pfannenstiel incision. The uterus was in retroversion but it was freely movable. Few adhesions were present in the pelvis. The fallopian tubes were only slightly injected and both were patent. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected in the usual manner. The uterus was suspended in the normal position. The postoperative course was afebrile and without incident. She was discharged from the hospital on the fifteenth postoperative day. Follow-up examination on September 10, 1930, 3 months after the operation, showed the patient to be in an excellent state of health. She had gained in weight. Her menstrual periods had been regular and painless. On rare occasions she has had a slight, dull pain

in the left lower quadrant of the abdomen but it has never interfered with her activities. Further follow-up examination in January, 1931, showed that the beneficial effect of the operation was lasting. Menses were regular, painless, and of moderate flow. The crises of lower abdominal pain have completely disappeared.

CASE 20. This patient was an unmarried woman, aged 25 years, who was sent to the hospital because of severe dysmenorrhœa. Menses began when she was 17 years of age, and they were always regular, profuse, of 8 days' duration, and moderately painful. In 1929, she gave birth to a normal full-term child. Since the birth of that child she has had severe lower abdominal pains, which are especially marked at the menstrual periods. She has continued to have a profuse leucorrhœa, no urinary disturbances, but marked constipation. Laparotomy was performed on June 5, 1930 (Pfannenstiel incision). The uterus was found in marked retroversion. Both ovaries showed moderate cystic degeneration. The fallopian tubes were injected but they were patent. The superior hypogastric plexus was isolated, and a segment about 1 inch long was resected. The uterus was suspended in the normal position. The appendix was removed. The postoperative course was uneventful. Follow-up examination on September 10, 1930, showed the patient to be in excellent health. Menses were regular and painless. The abdominal pain had entirely disappeared. Follow-up examination in March, 1931, revealed the fact that the patient was about 3 months' pregnant. Menses had been regular until the onset of the amenorrhœa of pregnancy. The pregnancy is progressing normally. Patient has had no abdominal pain.

CASE 21. The patient was a married woman, aged 34 years, who was referred to the hospital because of severe dysmenorrhœa. Her menses began when she was 13 years of age and they had always been regular, profuse, and moderately painful. She has two children living and well, aged 7 and 14 years, respectively. She has had two miscarriages and each was followed by a curettage of the uterus. In 1920, she was operated upon for a cyst of the left ovary. During the past 7 years she has had severe pains in the right lower quadrant of the abdomen with each menstrual period. The pain is very severe during the first 2 days of the menstrual flow. The pain usually causes the patient to vomit profusely. Physical examination was negative. Vaginal examination revealed the cervix of the uterus to be bilaterally lacerated. The right ovary felt somewhat larger than normal. The uterus was freely movable. Laparotomy (Pfannenstiel incision) was performed on July 26, 1930. The uterus was in second degree retroversion. The left fallopian tube and ovary were missing. The right ovary was large and showed marked cystic degeneration. A partial resection (quadrant) of the right ovary was done. The superior hypogastric plexus was isolated and a portion about 1 inch long was resected. The uterus was suspended in the normal position. The postoperative course was uneventful. At the time of discharge from the hospital the patient was completely relieved of all her former complaints. Repeated follow-up examinations showed the relief from the pelvic and abdominal pain to be lasting. In January, 1931, the patient was still free from pain.

CASE 22. This patient was a married woman, aged 54 years, who was referred to Professor Leriche because of sharp shooting pains in her left leg and marked pruritis of the vulva. Prior to her present illness, she had always been in good health. She has three children living and well. Menopause occurred in 1929. In January, 1930, she developed phlebitis of the left leg without apparent cause. The leg was immobilized and she remained in bed for 3 months. At the end of that time she attempted to get out of bed and sit up. Sharp shooting pains in the left leg and a burning sensation in the sacral region then appeared. A short time later she developed pruritis of the vulva. General physical examination was negative. Vaginal examination revealed a very firm cervix but no evidence of malignant disease. The uterus was small and freely movable. Laparotomy was performed on April 29, 1930, by Professor Leriche. The uterus and ovaries were atrophic. There was no demonstrable cause for the severe pain in the pelvis and in the left leg. A peri-arterial sympathectomy of the left common iliac artery was done, and this sympathectomy was continued upward and some of the pre-aortic and peri-aortic sympathetic fibers were also removed. Because of the great vascularity of the adventitia of the aorta, it was impossible to perform a complete peri-aortic sympathectomy. The superior hypogastric plexus was then isolated and completely resected. The postoperative course was uneventful. The relief from the severe pains was immediate and lasting. On May 16, 1930, she was discharged from the hospital and entirely free from all of the former pain. Several follow-up examinations have shown the relief to be lasting. About 5 months later her daughter wrote the following note to us: "My mother is in an excellent state of health, she does not suffer any longer. She remains standing all day from 6 a.m. until 10 p.m. and does all of her housework."

SUMMARY OF THE RESULTS OBTAINED IN THIS SERIES OF CASES

Fifteen of the 22 patients that have been submitted to a resection of the superior hypogastric plexus because of some form of severe pelvic pain have had repeated follow-up examinations over a long period of time. Six of the 22 patients have failed to return for follow-up examination, but at the time of discharge from the hospital they were completely relieved of the pelvic or abdominal

pain. One patient died on the second postoperative day. Thirteen of the 15 patients that have been followed have declared themselves relieved of all pelvic or abdominal pain. One patient has remained free from pain for over 4 years while one other has had no recurrence of her former symptoms during the 2½ years that have elapsed since the operation. Two of the 15 patients that have been followed have had only slight or no benefit from the pelvic sympathectomy. We believe that these results (Table I) justify the resection of the superior hypogastric plexus as a means of relieving severe pelvic and lower abdominal pains.

TABLE I.—SUMMARY OF THE RESULTS OBTAINED BY PELVIC SYMPATHECTOMY IN TWENTY-TWO CASES OF DYSMENORRHŒA AND HYPOGASTRIC PLEXALGIA

Case Age	Time interval between operation and last follow-up examination	Clinical results and remarks
1 18	4 years	Completely relieved of pelvic pain
2 30	4 months	Failure, no improvement, hysterectomy
3 21	5 weeks	No follow-up. Complete relief in hospital
4 24	1½ days	Patient died on 2d postoperative day
5 20	21 days	No follow-up. Partial relief of pain
6 35	16 days	No follow-up. Relief during hospital stay
7 25	2½ years	Completely relieved of pelvic pain
8 39	20 days	No follow-up. Relief during hospital stay
9 26	23 months	Failure, no improvement
10 42	21 days	No follow-up. Relief during hospital stay
11 19	20 months	Complete relief. 6 months pregnant
12 17	21 days	No follow-up. Relief during hospital stay
13 27	1½ years	Completely relieved of pelvic pain
14 30	16 months	Completely relieved of pelvic pain
15 27	8 months	Completely relieved of pelvic pain
16 25	4 months	Completely relieved of pelvic pain
17 30	4 months	Completely relieved of pelvic pain
18 15	8 months	Temporary retention of urine. No pain
19 21	7 months	Completely relieved of pelvic pain
20 25	10 months	Complete relief. 3 months pregnant
21 34	6 months	Completely relieved of pelvic pain
22 54	5 months	Completely relieved of pelvic pain

RESECTION OF THE PELVIC SYMPATHETIC NERVES FOR THE RELIEF OF PAIN DUE TO INOPERABLE NEOPLASMS IN THE PELVIS

In 1925, Professor Leriche suggested the resection of the superior hypogastric plexus (presacral nerve) from its origin at the intermesenteric plexus to the lower part of the aortic bifurcation together with the resection of both lumbar sympathetic chains for the complete relief of the severe pain due to inoperable neoplasms in the pelvis. Tisserand applied this procedure some time later, and he also obtained excellent results. More recently, Ferey has advocated only the section of the superior hypogastric plexus for the relief of pain associated with extensive neoplastic infiltration in the pelvis. In Roumania, Gomoiu (1920), Georgesco (1926), and Crainicianu (1928) and, in France, Bernard and Theodoresco (1928) have reported excellent results in regard to relief of the pelvic pain by simple section of the superior hypogastric plexus. The results published by Ferey (1929) showed that only partial relief of the pelvic pain was obtained by this simple procedure; however, he still advocates the procedure in every case in which an hysterectomy is performed for carcinoma of the uterus. It is because of the fact that simple section of the superior hypogastric plexus does not always give complete relief of the pain that we have been advocating the more complete removal of the pelvic sympathetic nerves. There is no great added risk in performing the complete pelvic sympathectomy as described by Professor Leriche and one can be quite certain of complete relief from the most intolerable pelvic pains. We believe that it is superior to cordotomy, since it gives complete relief from the pain without sacrificing any of the normal protective reflex pathways of the individual.

The results which Professor Leriche has obtained by complete pelvic sympathectomy for

the relief of intolerable pain due to inoperable neoplasms in the pelvis can best be obtained by a study of the abstracts of the following six cases.

CASE 23. This patient was a married woman, aged 33 years, who was referred to Professor Leriche because of intolerable pains in the pelvis and right leg associated with an inoperable carcinoma of the cervix of the uterus. She had had several courses of deep X-ray therapy without improvement in the pain. In October, 1925, she began to have sharp shooting pains in the right leg. A short time later, the pain became diffuse over the entire lower abdomen and pelvis with radiation down the right thigh. The patient required large quantities of morphine to relieve the intense pain. Vaginal examination revealed a very hard induration in the cul-de-sac and in both broad ligaments of the uterus. The uterus was fixed. Laparotomy was performed on November 19, 1925 by Professor Leriche. The uterus and adnexa were fixed posteriorly. There were many large, hard lymph nodes in the pre-aortic group. The superior hypogastric plexus was isolated and a segment about 2 inches long was resected. Several hard lymph nodes were removed for histological examination. The common iliac arteries were exposed and a peri-arterial sympathectomy was done on each of these arteries. The postoperative course was uneventful. The pain was greatly relieved. She complained only of an occasional dull pain in the pelvis. Because of the extensive metastasis, the patient gradually became worse and finally died on December 8, 1925. During the last few weeks of her life, however, the intolerable pain had completely disappeared, and during the greater part of the time she was very comfortable without morphine.

CASE 24. This patient was a married woman, aged 42 years, who was referred to the hospital because of intense pain in the pelvis with radiation of the pain to both thighs. In December, 1926, she consulted her family physician because of metrorrhagia. After examination, a diagnosis of carcinoma of the cervix uteri was made and the patient was referred to the hospital for X-ray and radium therapy. A short time later the patient began to have a marked burning sensation in the pelvis and associated with cramp-like pains which radiated to both thighs. No urinary disturbances were noted. Vaginal examination revealed an irregular, stony-hard mass in the upper part of the vagina with infiltration of the vaginal wall and large hard masses in both sides of the pelvis. Laparotomy was performed on July 24, 1926, by Professor Leriche. The uterus and rectum were bound together in one large neoplastic mass. The pre-aortic plexus was isolated, and the entire plexus from the origin of the inferior mesenteric artery to the lower part of the superior hypogastric plexus was resected in one mass. The lower lumbar and upper sacral sympathetic chains were removed. The two internal iliac arteries were isolated, and a complete peri-arterial sympathectomy was done on each of them. Thus the complete pelvic sympathectomy consisted of: (1) removal of the pre-aortic sympathetic plexus; (2) removal of the superior hypogastric plexus; (3) removal of the fifth lumbar and first sacral sympathetic ganglia on each side; and (4) bilateral peri-arterial sympathectomy of the internal iliac arteries.

Immediately after this operation the pains disappeared completely. A slight tenesmus of the vesical and rectal sphincters remained. The improvement was very striking, and the patient was discharged from the hospital on August 5, 1926. She continued to be without pain or discomfort and she remained very comfortable until the day of her death in March, 1927. She was completely relieved of all suffering for over eight months.

CASE 25. This patient was a married woman, aged 52 years, who was referred to the hospital because of severe pains in her right leg associated with marked œdema of that member. In April, 1926, she was submitted to a total hysterectomy for a carcinoma of the cervix uteri. The immediate postoperative result was good but several months later she noticed œdema of the right leg. This œdema gradually became worse and in April, 1927, she began to have intense pain in the entire right leg. At first the pains were limited to the anterolateral surface of the right thigh. The circumference of the midportion of the thigh on the right was 10 centimeters greater than that on the left. The patient was crying out almost constantly because of the excruciating pain in the leg. Vaginal examination revealed a large, irregular, stony-hard mass in the pelvis. Laparotomy was performed on May 15, 1928, by Professor Leriche. The entire pelvis was filled with a hard neoplastic mass. The infiltration extended up the posterior parietal peritoneum and around the bifurcation of the aorta. It was impossible to isolate the iliac arteries. With great difficulty the upper branches of the superior hypogastric plexus were isolated and resected. In attempting to free the mass from the posterior wall, several small abscesses were broken into and consequently the operation could not be completed. Drainage was instituted and the abdomen was partially closed. The proper pelvic sympathectomy could not be performed in this case. This operation had no influence upon the œdema and did not relieve the pains in the thigh. Since complete pelvic sympathectomy could not be performed in this case, Professor Leriche resorted to section of the posterior commissure of the spinal cord at the level of the sixth and seventh dorsal vertebræ. Definite improvement followed this operation. The extension of the neoplasm continued, however, and the patient died on June 30, 1928.

CASE 26. The patient was a married woman, aged 38 years, who was referred to the hospital because of severe, sharp pains in the pelvis and radiating down both thighs. Several months previously, the diag-

nosis of an inoperable carcinoma of the cervix uteri was made and the patient was given several courses of deep X-ray and radium therapy. During the month prior to admission to the hospital, the pains in the pelvis had been aggravated by the X-ray therapy. The pains had varied in intensity and location so much that it was impossible to localize the cause for the pain by clinical examination. Laparotomy was performed on November 15, 1929, by Professor Leriche. The neoplasm had extended into both broad ligaments of the uterus. The retroperitoneal lymph glands were large and hard. The lower part of the aorta was compressed by a large mass of stony hard lymph nodes. The superior hypogastric plexus was isolated, and a segment about 2 inches long was resected. Both lumbar sympathetic chains were sectioned at the level of the fifth lumbar sympathetic ganglion. The complete isolation of the lumbar sympathetic chains was made impossible by the large masses of hard, coalescing lymph nodes.

Following this operation the pains in the thighs and pelvis disappeared completely. There were no urinary disturbances following the operation, and defæcation was normal. During the entire stay in the hospital, the patient failed to have any recurrence of the pain. She was allowed to return to her home on the twentieth postoperative day. We have been unable to trace the patient and consequently no further follow-up data can be obtained.

Case 27. The patient was a married woman, aged 50 years, who was referred into the hospital because of excruciating pains in both thighs and in the left leg. In July, 1929, she developed phlebitis of the left leg, and a short time later the severe pains began in that leg. She was treated for sciatica for several months but finally she was referred to the neurological clinic where a very extensive carcinoma of the cervix uteri was discovered. Radium therapy was instituted but this only aggravated the pain. The sharp lancinating pains radiated to the anterolateral aspect of the left thigh. Laparotomy was performed on March 29, 1930, by Professor Leriche. An extensive neoplastic tumor was found in the pelvis and extending along the mesosigmoid. With some difficulty the pre-aortic plexus of sympathetic nerves was isolated and removed as completely as possible. The inferior mesenteric nerve was sectioned at the level of the fourth lumbar vertebra. The left lumbar sympathetic chain was isolated at this level and a portion about 1 inch long was resected, this portion included the right fourth lumbar sympathetic ganglion.

Following this extensive pelvic sympathectomy the patient was entirely relieved of all her former symptoms. She remained in the hospital until her death on September 14, 1930, and at no time did she complain of pain or discomfort. She was given 6 months of complete freedom from the excruciating pains in the legs by the pelvic sympathectomy.

Case 28. This patient was a married woman, aged 58 years, who was referred to the hospital because of constant pain in the pelvis with lancinating pains radiating down the anterior surface of the right thigh. Five months prior to her admission to the hospital, a diagnosis of carcinoma of the cervix uteri was made and the patient was submitted to radium therapy. The bleeding ceased after the radium therapy. About 2 months later she began to have sharp pains in the pelvis. These pains have constantly grown worse in spite of vigorous medical and radium therapy. The patient was also suffering from marked hypertension and an associated myocardial insufficiency. At the time of admission to the surgical clinic the pains were constant and very violent in character. After complete digitalization by the medical attendant, the cardiac condition was greatly improved, and an operation was advised. Laparotomy was performed on July 23, 1930. A large, irregular, stony-hard, retroperitoneal mass was found in the hollow of the sacrum. The internal genital organs were displaced anteriorly and immobilized by this mass. The peritoneum was adherent to the mass. Many of the pre-aortic lymph glands were enlarged, hard, and firmly adherent to the surrounding tissues. The pre-aortic plexus of sympathetic nerves was matted together by neoplastic tissue. As much as possible of this tissue was removed with the hope of removing the pre-aortic plexus at the same time. The superior hypogastric plexus was isolated and a segment about 2 inches long was resected. The right lumbar sympathetic chain was identified and sectioned just above the level of the fourth lumbar sympathetic ganglion. It was technically impossible to expose the left lumbar sympathetic chain in this patient. Following this operation the patient was completely relieved of all pelvic pain and throughout her stay in the hospital there was no recurrence of the pain in the pelvis or in the thighs. There were no urinary disturbances. The patient was discharged from the hospital on the twenty-first postoperative day. All of the former pain has completely disappeared. Repeated follow-up examination has shown the result to be lasting. In January, 1931, she was still without pain but she is gradually becoming weaker from the extension of the pelvic neoplasm. There has been no bleeding. This patient has had many months of comfort as the result of the sympathectomy.

PELVIC SYMPATHECTOMY IN RELATION TO THE CHRONIC ATROPHIC DISTURBANCES OF THE EXTERNAL GENITAL ORGANS

In 1921, Professor Leriche reported a case of krausosis vulvæ which he treated by periarterial sympathectomy of the internal iliac artery. The patient obtained complete and lasting relief by this operation. Follow-up observations on this patient were made over a period of more than 5 years.

Crainicianu (1928) reported several excellent results of periarterial sympathectomy of the internal iliac artery giving complete relief in cases of pruritis vulvæ. Two of our cases had marked pruritis of the vulva which was promptly relieved by the pelvic sympathectomy. Up until the present time pelvic sympathectomy has not been widely used in the treatment of the atrophic lesions of the external genital organs, consequently all the data available at present are not sufficient to warrant any remarks concerning the efficacy of that form of therapy. The ordinary medical, roentgenological, and surgical methods in use at the present leave much to be desired in the final result of the therapy.

SURGICAL TECHNIQUE FOR RESECTION OF THE SUPERIOR HYPOGASTRIC PLEXUS (PRESACRAL NERVE OF LATARJET)

The abdomen may be opened either by a median subumbilical incision or by the incision described by Pfannenstiel. In young, unmarried women, we prefer to use the Pfannenstiel incision as the resulting scar is usually within the pubic hair line. The illustration of the surgical exposure (Fig. 9) shows the usual low midline incision being used. The type of incision through the abdominal wall is, of course, of little real importance. Before the peritoneum is opened the patient is lowered from the horizontal position to the Trendelenburg position. The small intestines and colon are packed upward toward the diaphragm. The rectosigmoid colon is then retracted laterally to the left. The uterus and adnexa should be examined to verify the diagnosis. The promontory of the sacrum and the two common iliac arteries are then located. The posterior parietal peritoneum is then incised at a point just above the promontory of the sacrum and directly in the midline. Immediately beneath the peritoneum and anterior to the mid-sacral artery will be found the nervous filaments which constitute the superior hypogastric plexus (Fig. 9). In very thin women these fibers can be seen through the peritoneum, while in obese women the plexus is usually embedded in much adipose tissue. If the mesosigmoid is short, care must be taken not to injure the inferior mesenteric vessels. Frequently, several nerve fibers are densely adherent to the right iliac vein. After all the filaments have been isolated a segment, at least 1 inch long should be resected from each main nerve fiber in order to prevent any possible regeneration. The posterior peritoneum is then closed by a continuous suture of fine, plain catgut. Any supplementary operation that is indicated should be done at this stage of the operation. The abdominal wall should be closed in layers.

SURGICAL TECHNIQUE FOR PERFORMING THE PERI-ARTERIAL SYMPATHECTOMY OF THE INTERNAL ILIAC ARTERY

The abdominal wall may be opened in the same way as has been described for the resection of the superior hypogastric plexus. Before opening the peritoneum, the patient is placed in the Trendelenburg position. The peritoneum is then opened and the intestines are packed upward. The rectosigmoid colon should be retracted to the left. The common iliac artery is then located and followed peripherally to its bifurcation into the external and internal iliac arteries. The posterior parietal peritoneum is incised just over the internal iliac artery. For exposure of the common iliac artery the peritoneum is incised immediately over the artery at the point where the lumbo-ovarian ligament crosses the vessels. After the particular artery has been exposed, one may facilitate the removal of the adventitia of that artery by injecting a small amount of normal saline solution directly into the adventitial layer of the artery. In that manner the peri-arterial tissues will be distended and can then be easily removed by scissors or a sharp scalpel. After complete denudation of the chosen artery, the peritoneum is closed with fine plain catgut. The abdominal wall should then be closed in layers.

COMPLETE PELVIC SYMPATHECTOMY FOR RELIEF OF PAIN DUE TO INOPERABLE NEOPLASMS IN THE PELVIS

The abdominal wall should be opened by an incision in the midline, extending from just above the symphysis pubis to a point about 1 inch above the umbilicus. Before the

peritoneum is opened, the patient should be placed in the Trendelenburg position. The small intestines and colon can then be packed away easily toward the diaphragm. The extent and nature of the neoplasm should be determined at this time and a search should be made for the cause of the pain. The complete pelvic sympathectomy is then performed as follows: (1) Incise the posterior parietal peritoneum just over the lower portion of the abdominal aorta and remove all of the sympathetic nerves of the pre-aortic plexus from the origin of the inferior mesenteric artery to the promontory of the sacrum. (2) Isolate the superior hypogastric plexus and resect as much of it as possible. (3) Isolate the right lumbar sympathetic chain which is usually situated just at the lateral border of the inferior vena cava and resect at least two (usually third and fourth) of the lumbar sympathetic ganglia. (4) Isolate the left lumbar sympathetic chain which usually can be found just beneath the left border of the abdominal aorta and resect at least two of the lower lumbar sympathetic ganglia. After this neurectomy the peritoneum should be closed by a continuous suture of fine plain catgut. The abdominal wall should be closed in layers.

SUMMARY

The anatomical and physiological basis for the surgery of the pelvic sympathetic nerves in gynecology is now well established.

In the 22 cases of dysmenorrhœa or pelvic plexalgia, which have been presented, there has been complete and lasting relief from the pelvic pain in the great majority of the cases following the resection of the superior hypogastric plexus (presacral nerve).

Disturbances of micturition following this operation must be considered very rare. Clinical and experimental evidence has shown that the superior hypogastric plexus is essentially a pathway for afferent impulses from the internal genital organs.

The excruciating pain that is frequently associated with inoperable neoplasms in the pelvis can be completely relieved by an extensive pelvic sympathectomy. In all cases, even those in which the most extensive pelvic sympathectomy was performed, there have never been any serious complications that could be attributed to the operation: no motor paralysis, no ascending urinary infection due to paralysis of the bladder, and no sensory disturbances of any part of the skin. Since this operation also gives the surgeon an opportunity of verifying the extent and nature of the neoplasm at the same operation, we believe that it should be used in preference to cordotomy for the relief of intolerable pain in the pelvis that is due to an inoperable neoplasm of any of the pelvic organs, provided the pain is not due to metastatic foci in the vertebræ.

The indications and the surgical technique for the various forms of pelvic sympathectomy have been described in detail.

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HIGHLY MALIGNANT TUMORS OF THE PHARYNX AND BASE OF THE TONGUE

Identification and Treatment[1]

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THE most common malignant tumors of the pharynx and base of the tongue are the lymphosarcomata and the squamous cell epitheliomata graded 3 or 4. During a period of 14 years we have examined in The Mayo Clinic 1,393 patients with such tumors. The present study is a review of 624 of these tumors which have been examined microscopically.

It is well known that certain highly malignant tumors of the nasopharynx, pharynx, and base of the tongue are markedly radiosensitive, and that some of these, even in the presence of cervical metastasis, have disappeared completely under irradiation. Such tumors we have classified as lymphosarcoma and highly malignant epithelioma.

IDENTIFICATION OF NEOPLASMS

Squamous cell epithelial growths of the pharynx are still sometimes miscalled endotheliomata and branchiogenic carcinomata. In recent years, occasionally disagreement as to their identity has arisen due to their having been described, particularly by the Europeans, as lympho-epithelioma, and by others as transitional cell carcinoma. Often, too, they are confused with lymphosarcoma. New and Kirch pointed out that lympho-epithelioma and transitional cell carcinoma are in reality squamous cell epitheliomata graded 4. Schmincke is credited by Ferreri and Singer with the first clear histological description of lympho-epithelioma. Good descriptions of the neoplasm are also given by Derigs, Ghon and Roman, and Jovin (13). It is Schmincke's belief that the tumors are epithelial neoplasms of branchiogenic origin, composed of a net-like syncytium of epithelial cells with lymphocytes occupying the interstices. The syncytial epithelial cells and lymphocytes grow in true symbiosis, according to Ferreri, and Jovin (13). The same twofold structure occurs in metastatic growths, although Jovin noted their frequent peculiar features of giving rise to purely epithelial metastasis at a considerable distance from the primary growth. It is not known why metastatic growths are not always of the same cell type as the primary lesion. It is, indeed, strange that, on metastasizing, a mixed lymphoid and epithelial cell type of neoplasm should lose one of its types of cell. It appears to us that the lymphocytes noted in the primary neoplasm are not a growing part of the tumor but are found there only because such cells are abundant in the mucous membrane of the pharynx and nasopharynx. Ewing (6) stated that lympho-epitheliomata are in reality transitional cell carcinomata (also described by Quick and Cutler, 24). He stated, too, that the transitional cell carcinoma is the same tumor as that described by Crowe and Baylor, and by New (18); these three authors called it squamous epithelioma. Ewing (8) stated:

"The transitional-cell carcinomata arise from stratified epithelium of which the cells are delicate, without spines, do not produce keratin, and show little capacity to hornify. This type of epithelium is found over the tonsil, vault of the pharynx, nasal passages, base of the tongue and the nasopharyngeal sinuses. It often covers deposits of lymphoid tissue and hence has sometimes been called lympho-epithelium. Very anaplastic and malignant tumors derived from adult squamous cells may exhibit the same clinical features. The structure of the growth shows sheets of large, pale,

[1] The data presented in this paper are taken from a thesis submitted by Dr. Childrey to the faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Otolaryngology and Rhinology, June, 1931.

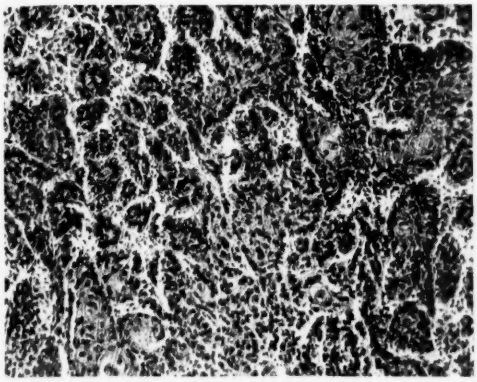

Fig. 1. Squamous cell epithelioma, graded 3, of tongue, too active to be graded 2; differentiation (hornification) and so forth, in upper portion, and less differentiation in cells in lower right corner may be noted.

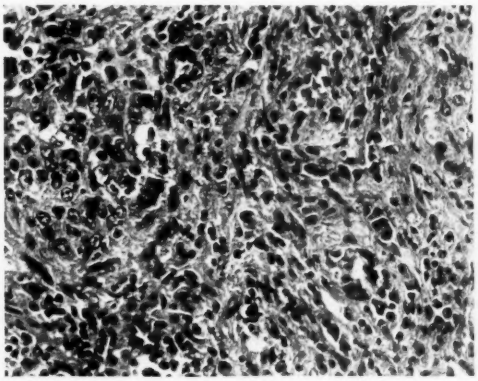

Fig. 2. Cervical lymph node; squamous epithelioma, graded 3; primary lesion was in nasopharynx; large squamous cells infiltrating lymphoid tissue may be noted; lympho-epithelioma was diagnosed previously.

delicate cells with thin membranes, large nuclei and indefinite cell outline. They infiltrate the submucosa or lymphoid tissue in sheets or small groups or singly. In the nodes, the cells may reveal some traces of squamous characters or they may become less differentiated and the structure may resemble lymphosarcoma."

Sections from squamous epithelioma, graded 3 (Figs. 1, 2, and 3) show both undifferentiated cells and those of a more adult type of growth. Both are unmistakably squamous epithelial cells. The undifferentiated type predominates, however, and this is the basis for the grading of malignancy of the tumor. The same type of undifferentiated cell is seen in greater abundance in sections of lesions graded 4 composed of 75 to 100 per cent of undifferentiated cells (Figs. 4, 5, and 6). It seems superfluous to call such growths transitional cell tumors. To do so is to create another type of carcinoma when there is no sound basis for doing so. It seems better that their identity with squamous cell tumors should be maintained. Regarding the diagnosis of endothelioma and branchiogenic carcinoma, occasionally made in this type of lesion, we quote Saareste, who regarded endothelioma as a "refuge of the destitute" which has too often been resorted to when a malignant neoplasm of the upper air passages could not be definitely classified as carcinoma, sarcoma, or mixed tumor (Fig. 4). Ewing (7) expressed the belief that endothelioma of the lymph nodes is rare.

Hudson pointed out that writers in the past have erroneously attributed a branchiogenic origin to squamous cell carcinoma found in the neck near the angle of the jaw. Most of these undoubtedly were metastatic from lesions primary in obscure situations such as the nasopharynx, the primary lesion passing unnoticed.

It is likely that certain observers will disagree with us in the diagnosis of squamous cell epithelioma, graded 4, which is often called lymphosarcoma or Hodgkin's disease (Figs. 4 and 5). Clinically, particularly as regards metastasis, there are some features common to both, and microscopically, too, it may be understood how some confusion might arise, particularly with regard to reticulum cell sarcoma (Fig. 8).

The structure of lymphosarcoma is rather specific (6). It presents a diffuse growth of lymphoid cells lying in reticular tissue (Figs. 7, 8, and 9). The structure of the affected node or follicle is obliterated. The cells vary in size, being small, medium, or large. The nuclei are compact or vesicular, always hyperchromatic, and nucleoli are not prominent. Two specific cells participate in the origin of lymphosarcoma, giving rise to two specific forms of the tumor. These cells are the reticu-

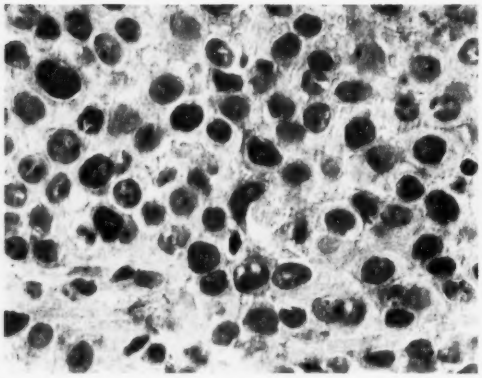

Fig. 3. Squamous cell epithelioma, graded 3, of pyriform fossa; this may be compared with lesion, graded 4, in Figure 6; cells of grade 3 type contain more protoplasm and are more differentiated.

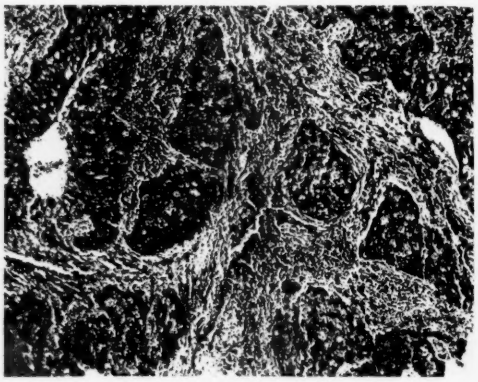

Fig. 4. Squamous epithelioma, graded 4, of nasopharynx; patient a girl aged 18 years who had had symptoms 2 years; lesion was diagnosed lymphosarcoma elsewhere; this type often called endothelioma.

lum cell of the germ centers of follicles and pulp cords, and the lymphocyte. The two types of lymphosarcoma are reticulum cell sarcoma or large round cell lymphosarcoma (Fig. 8), and malignant lymphocytoma (Figs. 8 and 9).

GENERAL CONSIDERATIONS

In the last 14 years, records have been made of 1,393 malignant tumors of the nasopharynx, oropharynx and hypopharynx, tonsil and base of the tongue. Only those lesions on which biopsy had been performed were reviewed. There were 624 cases in this group, of which 78 were lymphosarcomata; 267 squamous cell epitheliomata, graded 4; and 279 squamous cell epitheliomata, graded 3. Thus it was found that high grade squamous cell epithelioma is about seven times as common as lymphosarcoma. Epitheliomata graded 3 and 4 were approximately equally common.

About half of the lymphosarcomata and epitheliomata graded 4 were found to be primary in the nasopharynx. Lesions graded 3 were more often primary in the tongue (45.9 per cent). Only 18.9 per cent of all lesions were primary in the tonsil. This figure is roughly correct for the kinds of malignant tumors. Over 60 per cent of lesions of the hypopharynx were epitheliomata graded 3. There were no lymphosarcomata in this situation.

Of the 624 patients, 84.2 per cent were males. The average age of 546 patients with epithelioma was 52 years, and that of the 78 patients with lymphosarcoma, 45.2 years. Both lymphosarcoma and epithelioma were noted among patients aged less than 20 years. There were 15 such patients whose average age was 14 years. All of these tumors were primary in the nasopharynx except one of the tonsil. The youngest patient with lymphosarcoma was aged 4 years and the youngest with epithelioma was aged 3 years.

The average duration of the tumor before treatment in all cases was 9.6 months. In a few exceptional cases, usually of lesions graded 3, the duration of the disease varied from 3 to 30 years. It seems probable that such lesions had arisen on the base of some other type of neoplasm, such as mixed tumor, which had undergone further malignant change.

SYMPTOMS AND SIGNS

Symptoms and signs of these malignant growths are often bizarre, particularly when the lesion is primary in the nasopharynx, when they may be referred to the nose, ear, eye, throat, tongue, head or face. In many cases, symptoms are secondary to lesions of the cranial nerves. Twenty-four and seven tenths per cent of patients with lesions in various situations, and 42 per cent of those with lesions of the nasopharynx, stated that enlarged cervical lymph nodes had been the first sign of trouble. Nasal obstruction was the most

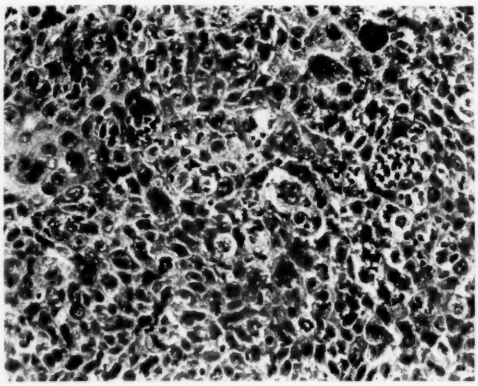

Fig. 5. Squamous epithelioma, graded 4, of palate; mitosis present; lesion had been causing symptoms 6 months; patient had been treated previously for syphilis and trench mouth, and lesion was diagnosed sarcoma elsewhere.

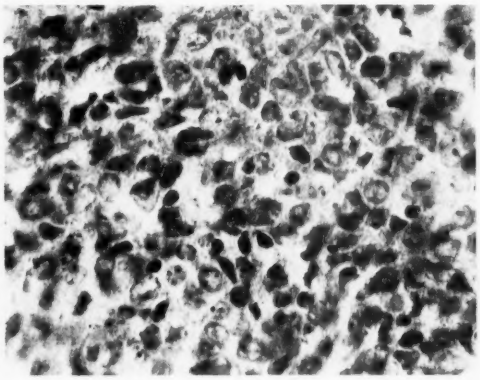

Fig. 6. Squamous cell epithelioma, graded 4, of nasopharynx; on examination patient had bilateral enlarged cervical lymph nodes, noted for 3 years, and paresis of third, fourth, fifth, sixth, and eighth cranial nerves on right side and sixth cranial nerve on the left.

common early symptom of lymphosarcoma of the nasopharynx, probably because of its tendency to produce bulky growths. Four lesions, 2 of the nasopharynx and 2 of the tonsil, did not cause symptoms or signs and they were discovered in the course of general examination.

Woltman has shown that if there is involvement of a cranial nerve from a malignant lesion of the nasopharynx, such involvement is likely to be multiple. In 31.8 per cent of 194 cases of lesions of the nasopharynx, there was cranial nerve palsy with an average of 2.9 nerves affected by palsy in each case. The sixth, fifth, and ninth nerves were more often affected. Involvement of the nerves was highest in cases of lesions graded 3, and lowest in cases of lymphosarcoma. The latter is a softer, bulkier type of neoplasm, with less tendency to infiltrate.

Neoplasms of the hypopharynx were responsible in 33.3 per cent of cases for paralysis of the vocal cords. This explains in part why this group of lesions is one of the most unfavorable from the standpoint of selection for treatment.

DIFFERENTIAL DIAGNOSIS

The diagnosis is difficult to make. The possibility of malignancy at any age must be kept in mind. Enlarged metastatic lymph nodes are most often confused with the enlarged cervical nodes of tuberculosis, leucæmia, and syphilis, or with the indurated swelling seen in actinomycosis; cystic tumors of the branchiogenic cleft or those originating in the thyroglossal duct, as well as benign or malignant enlargements of the thyroid gland, may cause confusion. A diagnosis in the presence of cervical metastasis should be easy if the primary lesion is found. In many instances it is overlooked. If discovered its nature is not always evident. Biopsy is usually indicated.

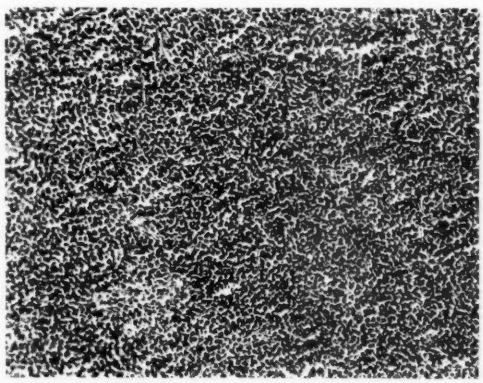

Fig. 7. Lymphosarcoma of inguinal lymph node. Both tonsils were involved; patient died, after 6 years, of sarcomatosis.

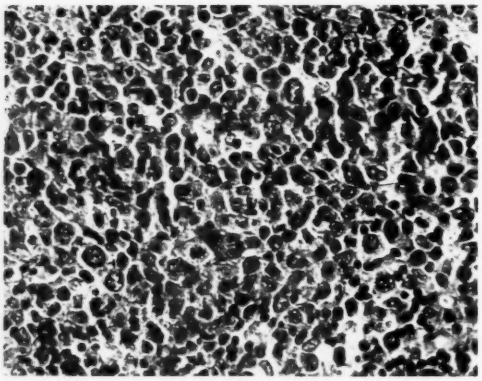

Fig. 8. Reticulum cell lymphosarcoma of tonsil which had been causing symptoms 2½ months; tonsils had been removed; on admission patient had enlarged metastatic cervical lymph nodes and was given irradiation (palliative only); death from pneumonia 3 months later.

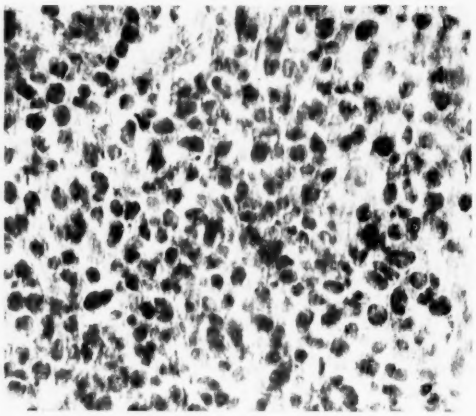

Fig. 9. Lymphosarcoma of base of tongue which had been causing symptoms for 9 months; patient died 5 months after examination; cells in lymphosarcoma are smaller than those of epithelial growths; this section may be compared with Figures 3 and 6.

Although primary lymphosarcoma of the pharynx and leucæmia have some features in common, at times an apparently identical microscopic appearance of the tonsils, distinction is important from the prognostic standpoint. In leucæmia the lymph nodes are usually discrete, painless, and moderately firm, similar to those in lymphosarcoma. In both conditions the cervical nodes may be massive, but early in leucæmia there is generalized adenopathy, while this is not true in the early stages of primary lymphosarcoma. In lymphosarcoma there is a locally destructive primary lesion, and true metastasis occurs in distant organs. The two conditions are further distinguished by the blood picture accompanying leucæmia. In cases of epithelioma graded 4 seen at the clinic, it was found that the most common error in diagnosis was Hodgkin's disease.

TREATMENT

Selection of patients. In selection of patients for treatment (Table I) several factors are to be considered, the most important of which is the type of lesion. The site and extent of the primary lesion and whether there is demonstrable cervical, intracranial, or general metastasis is also important. The probable duration of the disease and the amount and type of previous treatment may indicate whether the case is favorable. The age and general condition of the patient must be taken into consideration. Whether the patient will be able to remain under observation or return for observation and further treatment, should the latter be necessary, is important. He should be under the care of a competent physician, who is equipped to give roentgen-ray or radium treatment for 1 or 2 years at least.

Ideal cases were seldom encountered; the incidence of cervical metastasis was high and the average duration of symptoms was long. Extensive lesions were seen in cases in which the history was short. In a number of cases, patients who for various reasons fell into the unfavorable group were given one or several treatments for the palliative effect. These are classified as untreated. Later they will be separated from patients who actually did not receive treatment, in order to show the effect, if any, of palliative measures.

Ratio of treated to untreated patients. The ratio was about the same for the two 7-year periods over which the patients were observed (Table II). One hundred eighty-two (29.15 per cent) of 624 patients were treated. The most favorable lesions were the lymphosarcomata, 43.6 per cent of which were treated; the least favorable were epitheliomata, graded 4, 23.95 per cent of which were treated.

TABLE I.—ONE HUNDRED EIGHTY-TWO PATIENTS TREATED AND FOUR HUNDRED FORTY-TWO PATIENTS UNTREATED

	Treated	Untreated
Lymphosarcoma		
Average age in years	46.0	43.8
Duration of symptoms—months	7.5	7.5
Metastasis on admission—per cent	61.75	77.25
Previous operations elsewhere—per cent	50.0	70.5
Squamous cell epithelioma—graded 4		
Average age in years	52.0	50.2
Duration of symptoms—months	9.8	9.2
Metastasis on admission—per cent	70.3	80.8
Previous operations elsewhere—per cent	45.3	46.3
Squamous cell epithelioma—graded 3		
Average age in years	54.8	55.1
Duration of symptoms—months	7.3	13.8
Metastasis on admission—per cent	36.9	82.0
Previous operations elsewhere—per cent	23.6	28.2
All types		
Average age in years	52.2	51.7
Duration of symptoms—months	8.2	11.1
Metastasis on admission—per cent	53.25	81.0
Previous operations elsewhere—per cent	36.22	40.8

Lesions in the hypopharynx were least favorable for treatment, for only 7.68 per cent of these were treated. Growths of the anterior two-thirds of the tongue could be treated best (52.52 per cent), and malignant lesions of the tonsils could be treated next best (39.1 per cent).

Epithelioma and sarcoma of the pharynx, usually considered as primary in the tonsil, have been treated much the same, principally by surgical procedures (17). It is now recognized that lymphosarcoma is a highly cellular, undifferentiated radiosensitive type of tumor and it is agreed that irradiation is unquestionably the treatment indicated (1, 4, 11, 16, 18, 21).

It appears that lymphosarcoma may definitely vary in activity, as does squamous cell epithelioma; on the whole it is more malignant and more radiosensitive than the active types of epithelioma. The necessity for general recognition of the fact that a large proportion of epithelial growths of the pharynx and tongue are of an undifferentiated, radiosensitive type of cell structure is apparent in the still common reports of treatment of series of cases of carcinoma in these regions. It appears that considerable treatment by operation, diathermy, or cautery, is still being carried out

TABLE II.—PATIENTS TREATED IN FIRST AND SECOND SEVEN YEAR PERIODS*

	1916–1922			1923–1929		
	Patients seen	Treated		Patients seen	Treated	
		No.	Per cent		No.	Per cent
Lymphosarcoma	55	26	47.25	23	8	34.9
Squamous cell epithelioma, graded 4	54	17	31.5	213	43	20.19
Squamous cell epithelioma, graded 3	70	19	27.1	209	65	31.1
All types	179	62	34.6	445	116	26.1

*Four of the treated patients were not traced.

for lesions which might be better treated by irradiation alone. Only relatively few physicians have referred to the highly cellular, undifferentiated types of epithelial growths, which follow the law of Bergonie and Trebondeau in their radiosusceptibility (2, 3, 6, 9, 23, 25). New (19) has pointed out that for epitheliomata of the pharynx, graded 3 or 4, radium alone is used if the lesion is too extensive for excision by cautery. For lesions of the tongue, graded 4, the usual excision of the cervical lymph node is omitted, radiation alone being employed (15). Quick treated 473 patients with all types of carcinoma of the tongue, variously situated. Of these, 23 (4.8 per cent) were free of disease for more than 5 years, some of them as long as 10 years.

We believe that some of the poor results obtained in the past in treating these lesions have been due in large measure to lack of care in selecting cases, omission of careful microscopic grading of carcinoma and lack of knowledge of the radiosensitivity of certain types. It is possible that these lesions may be activated by incomplete surgical procedures. Localized, accessible lesions of the tonsil, tongue, or pharynx may be excised surgically or by diathermy or cautery, followed by the insertion of radium directly into the wound by means of needles or emanation seeds. In the low grade lesions, this is followed by surgical removal of the lymph nodes of the neck which drain this area. If the primary lesion is extensive, with or without large lymph nodes, irradiation probably offers the only chance, which

is palliative only. Radium needles or emanation seeds may be used for the primary lesion when it is infiltrating. Needles or emanation seeds should not, however, be used for a primary lesion which has extended so that there will be danger of severe hæmorrhage subsequent to the separation of the slough, unless the external carotid has been ligated. In such cases radium applied to the surface of the growth is indicated. Surface irradiation is the usual method used for lymphosarcoma. However, needles are frequently inserted directly into the local tumor in addition to the application of deep roentgen rays externally. The dosage must be carefully measured, for even with radium used in this manner too large a dose may produce dangerous sloughing. With extensive lesions, palliation is all that should be expected of any form of treatment. Too often patients present themselves with extensive primary lesions, encroaching on the deeper vessels. Ligation of the external carotid artery may be the first step necessary in prevention of a fatal hæmorrhage from a large, eroded vessel.

In the nasopharynx, radium applied to the surface of the neoplasm should be the only therapeutic measure for either type of growth. In the oropharynx and hypopharynx a few cases may be encountered in which the primary lesion is small enough to be destroyed with diathermy or the cautery, but these are exceptional. Usually the emanation seeds are the best form of treatment for epithelial lesions of the oropharynx and hypopharynx. Lesions of the hypopharynx which are not easily accessible to seeds or needles, as is often the case, may be treated with surface irradiation.

If the primary lesion is graded 3 and cervical nodes are palpable, partial or complete block dissection of the nodes may be done. This is preceded and followed by irradiation and with radium. If the primary lesion is graded 4, radium alone is as a rule used to the neck, whether lymph nodes are or are not palpable. Radium needles or emanations are not used for the regional nodes, for the trauma incident to their insertion is likely to stir up too active a process, and accuracy of insertion is questionable. Roentgen-rays were used in some instances. Usually, however, such treatment was reserved for palliation, or when expediency was desirable.

Previous operative treatment. Of 467 patients treated elsewhere, 246 (39.42 per cent of the series of 624) had been operated on, and 308 operations had been done. Patients with lymphosarcoma had had relatively the greatest number of operations; 96.3 per cent of patients with lesions of the nasopharynx had been operated on. Of 185 operations in cases of malignant lesions of the nasopharynx, the most common single operation was tonsillectomy (39). The largest group of operations were those on the nose (56), which included operations on the maxillary sinuses as well as removal of polypi, turbinates or septum. Cervical lymph nodes were operated on in 33 cases, and teeth were extracted in 20 cases. In a few of the cases, mastoidectomy or myringotomy and injections of alcohol for trifacial neuralgia had been done.

Of 432 patients with malignant lesions of the tonsil, pharynx, hypopharynx and tongue, 112 had been operated on 123 times. The operations most commonly performed were removal of tonsils, cervical lymph nodes, teeth and tumor. Only 42 of the 467 patients treated previously had had biopsy.

Previous non-operative treatment. A great variety of methods of non-surgical treatment was used. Local treatment to the throat comprised 31.46 per cent; antisyphilitic or "serum" treatment, often given in the absence of a history or positive blood test for syphilis, comprised 11.61 per cent. Internal medication, intravenous medication, baths, Chinese herbs, and a fair amount of treatment by light had been used. In some cases other methods of healing, as practiced by followers of Abrams, chiropractic, naturopathy, and osteopathy, were employed. Roentgen-rays were employed in 20.05 per cent, and radium in 14.25 per cent.

Patients traced. Of the 624 patients, 89.2 per cent were traced; the percentage was higher (96.7 per cent) among treated patients.

Epithelioma graded 4. All lesions graded 4 situated in the nasopharynx were treated with irradiation, usually with radium. Seventy-one and seven tenths per cent of all neoplasms

TABLE III.—RESULTS BY SITUATION OF LESION

Site	Type of growth	Total patients	Patients treated									Patients not treated		
				Traced		Living		Dead					Traced	
			Total	Cases	Average life, months	Cases	Average life, months	Good results	Average life, months	Fair results	Average life, months	Total	Cases	Average life, months
Nasopharynx	Lymphosarcoma	40	15	15	34.5	4	75.5	1	54.0	10	16.2	25	21	5.2
	Squamous cell epithelioma, graded 4	126	31	31	22.2	10	19.7	1	58.0	20	21.7	95	81	7.2
	Squamous cell epithelioma, graded 3	28	7	7	19.0	2	10.5			5	23.6	21	19	7.3
Pharynx	Lymphosarcoma	15	6	5	39.0	1	94.0	1	63.0	3	23.0	9	8	6.2
	Squamous cell epithelioma, graded 4	17	3	3	51.0	1	29.0	2	59.0			14	12	6.8
	Squamous cell epithelioma, graded 3	20	4	4	21.0	2	23.0			2	15.5	16	15	7.3
Tonsil	Lymphorsarcoma	17	9	9	68.0	5	83.0	3	63.0	1	11.0	8	6	13.0
	Squamous cell epithelioma, graded 4	45	15	15	43.0	8	41.0			7	22.0	30	24	6.1
	Squamous cell epithelioma, graded 3	53	21	20	38.7	5	55.8	4	76.5	11	17.1	32	28	6.6
Tongue (base)	Lymphosarcoma	6	4	3	68.7	1	125.0	1	53.0	1	28.0	2	2	3.5
	Squamous cell epithelioma, graded 4	40	7	7	34.0	4	43.0			3	22.0	33	27	10.5
	Squamous cell epithelioma, graded 3	82	24	23	35.0	9	50.7	3	45.0	11	19.6	58	21	8.2
Tongue (anterior two-thirds)	Lymphosarcoma													
	Squamous cell epithelioma, graded 4	11	4	4	30.0	3	37.0			1	8.0	7	4	6.0
	Squamous cell epithelioma, graded 3	46	26	24	34.0	12	38.8	3	55.3	9	21.3	20	19	7.4
Hypo-pharynx	Lymphosarcoma													
	Squamous cell epithelioma, graded 4	28	4	4	15.0	2	10.5			2	21.0	24	20	4.5
	Squamous cell epithelioma, graded 3	50	2	2	12.5	2	12.5					48	43	5.2
All sites	Lymphosarcoma	78	34	32	47.9	11	85.0	6	59.0	15	18.0	44	37	6.6
	Squamous cell epithelioma, graded 4	267	64	64	30.0	28	30.0	3	59.0	33	21.0	203	168	7.0
	Squamous cell epithelioma, graded 3	279	84	80	33.0	32	40.0	10	60.8	38	19.7	195	175	6.8
Total		624	182	176	34.5	71	43.1	19	59.0	96	19.9	442	380	6.8

graded 4 were treated with irradiation. In 1.56 per cent of cases, surgical procedures alone were used, and in 26.55 per cent, surgical procedures and irradiation were combined in the treatment. Cervical nodes were excised in 16 cases.

Of the 28 patients who were treated and are alive, 17 (60 per cent) had palpable lymph nodes on admission; 15 (52 per cent) had had operations of various types, and the average duration of symptoms of the 28 was 10.2 months. The best results were obtained if lesions were in the anterior two-thirds of the tongue, 75 per cent of these patients being alive after 37 months. The next most favorable results were obtained if lesions were in the base of the tongue, 57 per cent of these patients being alive after an average of 43 months. Among the 28 patients living, 9 show evidence of malignancy. Of the 36 patients treated who died, 3 lived an average of 59 months after examination. One hundred sixty-eight patients not treated lived only 6.9 months.

Epithelioma graded 3. All lesions graded 3 situated in the nasopharynx were treated with irradiation, usually with radium. Thirty-two and five-tenths per cent of all lesions graded 3 were treated with irradiation. Surgical procedures alone were used in 11.44 per cent. Irradiation and surgical procedures were used in various combinations in 56.25 per cent.

Of the 32 patients still alive, 10 had palpable cervical lymph nodes on admission, 6 had been operated on, and for all the average duration of symptoms was 7 months. Two of these lesions, involving the tonsil, were discovered accidentally following tonsillectomy. Six of the 32 living patients still showed evidence of malignancy, but 3 patients have been free of the disease more than 8 years.

The best results were obtained if lesions were of the anterior portion of the tongue, 50 per cent of patients being alive after 38.7 months. Better results were obtained if the lesions were of the hypopharynx, but only a small percentage of these lesions were treated. Of the 48 patients treated who died, 10 obtained good results; they lived an average of 60.8 months. The remaining 38 averaged 19.7 months of life. The average life of all treated patients who died was 28 months.

TABLE IV.—PERCENTAGE OF TRACED PATIENTS FREE OF RECURRENCE THREE TO ELEVEN YEARS AFTER TREATMENT

	Cases	Three years or longer		Five years or longer	
		Cases	Per cent	Cases	Per cent
Lymphosarcoma	32	15	46.8	11	34.3
Squamous cell epithelioma, graded 4	64	11	17.1	6	9.36
Squamous cell epithelioma, graded 3	80	22	27.5	15	18.7
Total	176	48	27.4	32	18.28

That lesions graded 3 are not as quickly fatal as those graded 4 is indicated by the fact that the 10 patients with epitheliomata graded 3 lived more than 5 years. That the 5-year cure is unreliable is indicated by the fact that 6 of these 10 patients died of carcinoma. They lived an average of more than 6 years. Indeed, one patient lived 7 years and 2 months. One hundred seventy-five untreated patients lived an average of only 6.8 months.

Lymphosarcoma. The treatment of lymphosarcoma consisted of irradiation except in 3 cases in which the tonsils were removed surgically before the radium was given. Half of the patients treated had had operations elsewhere. These did not get along as well as the other half. The length of life after examination, as well as the percentage of living patients, differs in favor of irradiation alone. Only 18.7 per cent of patients operated on previously are alive 6 years or more, whereas of those not operated on previously, 50 per cent are alive 6 years or more. The average life of all patients in the group treated with irradiation alone exceeds that of the others by 20.9 months.

Of the 11 patients living, on examination 6 (54 per cent) had palpable cervical lymph nodes on admission, and in 1 of these enlarged abdominal nodes were present. Three patients (27.3 per cent) had been operated on previously. The average duration of symptoms of the 11 was 6.8 months. The average length of life, from onset of symptoms to the present, of patients who have been treated has been 92 months (more than 7 years).

TABLE V.—DEATH RATE*

	Treated patients		Untreated patients	
	Deaths from all causes	Deaths from malignancy	Deaths from all causes	Deaths from malignancy
Lymphosarcoma	3.45	3.68	27.05	27.05
Squamous cell epithelioma, graded 4	4.16	4.30	14.49	14.38
Squamous cell epithelioma, graded 3	3.57	3.81	14.70	14.35

*The death rates are the quotients expressed in percentage, obtained by dividing the number of deaths by the number of months all the patients lived.

The highest percentage of living patients was noted in the group whose lesions were of the tonsil, in which 55 per cent have been alive 83 months. Of the 21 treated patients who died, 6 obtained fairly good results with an average life of 59 months after examination. The remaining 15 averaged 18 months of life.

That the current 5-year cure sought in treating carcinoma is unreliable is again indicated by 5 patients who were treated at the clinic. All died of malignant lesions from 42 to 72 months after examination, an average of 56 months after examination. One patient lived more than 6 years and died of diffuse sarcomatosis.

All lesions (*Table III*). Twenty-nine and sixteen hundredths per cent of the 624 patients were treated. Of the 176 patients who were treated and traced, 71 (40.3 per cent) were alive an average of 43.1 months later. Nineteen (10.8 per cent) lived for 59 months. Eighty-six (48.8 per cent) lived for 19.9 months. All treated patients who were traced lived an average of 34.5 months. All untreated patients who were traced lived an average of 6.8 months. Treated patients lived almost six times as long as those not treated. Treated patients who lived 3 or more years are subdivided according to the number of years they lived; 27.4 per cent of treated patients lived 3 years or more after treatment, and 18.28 per cent lived 5 years or more after treatment (Table IV).

The ideal study would include a series of cases preferably of early lesions which would be observed, untreated, over a period of months or years. Of the 442 untreated patients, 4 were alive 26 months after examina-

tion. It might be possible that a similar, larger group would show similar results. Only then could it be settled definitely whether the good results were the result of the treatment or of the selection of patients. Although treatment appears to be all important, it must be concluded that good results may be due to one or both of two factors: the treatment and the selection of the patient.

Palliative treatment. To determine the effect of palliative treatment in prolonging life, the group which included the untreated patients and those given palliative treatment, was divided into two groups; one included patients who received one or a few palliative treatments, and the other included those who had not been treated, as far as could be ascertained. It appears that unless the patient is seen early enough to be offered adequate treatment, it is just as well not to give any, as far as prolonging the patient's life is concerned. The average life in months of patients receiving palliative treatment was 6.9 months, and of those not receiving palliative treatment, 5.8 months.

In determining the prognosis of the patients in this series, the duration of symptoms of all traced patients was added to the length of life following examination. The life expectancy of all treated patients from the onset of symptoms was 42.7 months, and of all untreated patients 17.9 months. The prognosis for untreated patients is not as good for patients with lymphosarcoma and epithelioma graded 4 as it is for those with epithelioma graded 3. It was noted, however, that lymphosarcomata responded better to treatment than either of the epithelial neoplasms.

MORTALITY

The death rate (Table V) illustrates the variation in the degree of malignancy of the three types of lesions. The rate was calculated from the number of months the patients lived after treatment in order to avoid the higher percentage obtained when the rates are calculated from years of life. The rates show the effect of treatment.

Almost all of the deaths (96 per cent) were due to malignant neoplasia. In cases in which treatment was given the percentage of deaths due to malignant neoplasia was slightly less (90.5) than the percentage of these deaths (97.52) in the untreated group. Most of the deaths attributable to the malignant process were due to the local disease rather than to distant metastasis.

SUMMARY

The most common highly malignant tumors of the nasopharynx, pharynx, and tongue are the lymphosarcomata and epitheliomata graded 3 or 4. The latter have often been described as lympho-epitheliomata or transitional cell carcinomata, and are, at times, miscalled branchiogenic carcinomata or endotheliomata.

High grade squamous cell carcinoma is about seven times as common as lymphosarcoma. The latter is the most common type of sarcoma of the pharynx. Lymphosarcoma and epithelioma graded 4 are more often primary in the nasopharynx. Epithelioma graded 3 is seen more often in the tonsil, tongue, and hypopharynx.

Eighty-four and two-tenths per cent of all lesions occurred in males. The average age of patients was 52.1 years. A few of each type of lesion occurred among patients aged less than 20 years.

Twenty-four and seven-tenths per cent of all patients noted enlarged cervical lymph nodes as the first sign of the disease. On examination at the clinic, 71.4 per cent had cervical metastasis.

Thirty-one and eight-tenths per cent of lesions of the nasopharynx were complicated by cranial nerve palsy. Thirty-three and three-tenths per cent of lesions of the hypopharynx were complicated by palsy of the vocal cords. Symptoms and signs varied considerably in cases of lesions of the nasopharynx.

Twenty-nine and two-tenths per cent of all patients were treated. There was not much difference between treated and untreated patients; 74.95 per cent had been treated previously, and 39.42 per cent had been operated on previously.

A great variety of surgical and non-surgical treatment had been given previously in almost all cases, without the proper diagnosis having been made. Patients were treated at the

clinic by irradiation. Surgical procedures, diathermy, or cautery were used with this in selected cases. Lymphosarcoma was treated almost entirely with irradiation.

Eighty-nine and two-tenths per cent of the patients were traced. Seventy-one (40.3 per cent) of patients treated were alive after an average of 43.1 months. Nineteen (10.8 per cent) of patients treated lived 59 months. Eighty-six (48.8 per cent) of patients treated lived 19.9 months. Sixteen and forty-eight hundredths per cent of all patients treated are alive 3 years or more.

All patients treated averaged 34.5 months of life after examination, and all patients untreated averaged 6.8 months of life after examination. A higher percentage of patients with epithelioma graded 4 are alive, than of those with lymphosarcoma, but the duration of life after examination is longer in cases of lymphosarcoma.

Palliative treatment had little, if any, effect in prolonging life. The life expectancy from onset of symptoms of all patients treated was 42.7 months. The life expectancy from onset of symptoms of all patients untreated was 17.9 months. Of those who died, 96 per cent died of the malignant process, the local lesion causing the death of 84.5 per cent.

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THE SCIENTIFIC AND SOCIAL ASPECTS OF ORTHOPEDICS[1]

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AT the end of his admirable life Sir James Mackenzie justly said: "A lack of guiding principles is responsible for many haphazard methods. The result, too often, is that, though immense energy is expended, achievement is not commensurate with this expense." There is a consensus of opinion that the medical sciences stand more than any other in need of such principles. It will now be my purpose to sketch some rules which orthopedics has contributed; and in so doing I shall have to restrict myself to those which bear reference to the formation and the growth of bone.

When Andry in 1741 composed the word "orthopædics" and published the first booklet under this title, there was no reference to biological laws and rules: Congenital wry-neck is treated by massage with lukewarm wine and oil, the scoliotic kyphos by gently pressing both hump and chest. Spreading the arms by holding the ends of a long stick, is considered to lead to a flattening and a lengthening of the clavicles. The idea that such slight forces would cure deformities, implied a proportional fear of such forces acting on the normal body. Warning is given to avoid any more or less forcible pressure from the hands of the nurse or the wrappings of the child, and the application of oil or grease on the skin is recommended in order to soften the bones. Here we find orthopedics in a pre-empiric stage—a stage in which it remained for a whole century.

In the end of last century Hueter and Volkmann set up a rule according to which growth is retarded whenever pressure exceeds the normal, and growth is accelerated whenever pressure is diminished. It is known as Hueter-Volkmann's pressure theory, though pressure rule seems to be the better term. In what follows I shall try to prove that this rule refers only to a special case out of a number of possibilities. Nevertheless, it was a valuable contribution toward an insight into the cause of deformities, being the first allusion to muscle action and gravity as physiological stimuli to bone growth. It did not escape Volkmann's attention that the same difference in pressure caused a difference in growth in some cases and not in others. Therefore, he justly added that besides excessive or prolonged weight-bearing a weakness of the tissues, especially of the bone tissue, played a part in the development of the growth difference. The nature and the cause of this weakness, however, he did not define. Moreover, Volkmann realized that, quite apart from growth, excess of weight-bearing might lead to deformity in preformed bone; viz., by causing primary absorption of lime salts and secondary plasticity. He called the process interstitial absorption, a name also used by Hunter, though in a different sense. All this marks Volkmann as the first to give rules regarding the effect of mechanical stresses on the growth and the formation of bone substance, simple though they were.

In 1892 Julius Wolff's epoch-making book, *The Law of the Transformation of Bones*, was published, in which Wolff claimed to disprove what Hueter and Volkmann had asserted. Only a small portion of Wolff's transformation law has proved to be tenable; viz., the fact that the elements of the cancellous tissue modify their width and their direction, when the intensity and the direction of pressure stresses are modified. Those elements which no longer have to transmit functional stresses become thinner or disappear altogether, while in the direction of the modified stresses existing elements thicken or new elements are formed.

Tension stresses to which Wolff ascribed the same function, appear to constitute no trophic stimulus to bone. The mathematical-functional form of bones, which he proclaimed, and which ascribed to the bone substance a malleability not unlike that of the pre-empiric stage of orthopedics, does not exist. Some bones, viz., the protecting bones, e.g., the cranium, develop without the action of functional stresses. Even the supporting bones

[1] Lady Jones Memorial Lecture, delivered at University of Liverpool, February 17, 1931.

TABLE I.—EXPLANATION OF FIGURE I

	Water per cent	Ashes (calculated from the anhydrous substance) per cent	
The dense tissue in *a* contains	11.3	61.5	62.55
The dense tissue in *a* contains	11.1	63.6	
The spongy tissue in *b* contains	10.6	49.4	52.9
The spongy tissue in *b* contains	10.2	56.4	
Difference			9.65

Quantities expressed in percentage of weight

TABLE II.—EXPLANATION OF FIGURE 2

	Water per cent	Ashes (calculated from anhydrous substance)	
The dense tissue in *a* contains	9.2	62.5	62.4
The dense tissue in *a* contains	11.0	62.3	
The spongy tissue in *b* contains	9.7	60.8	56.2
The spongy tissue in *b* contains	11.3	51.6	
Difference			6.2

Quantities expressed in percentage of weight

will develop and maintain themselves apart from such action, although less completely. Under the influence of these stresses the supporting bones will form more bone than is needed to resist them. Moreover, the softer parts have their influence on the form of bones, since bone tissue has been proved to display a tendency to yield to the lateral pressure of neighboring tissues. Hueter-Volkmann's pressure rule was not disproved by Wolff, since it deals with growth, and Wolff has nowhere separated the growth of bone from its formation. Wolff's opinion that the formation of bone is always proportional to the intensity of the acting stresses appears to be untenable as opposing Volkmann's interstitial absorption under excessive pressure. Wolff overlooked the fact that a physiological curve has both a descending and an ascending part.

It has recently been shown that the dense bone tissue in a vertebra on the concave side of a lateral curvature contains a higher percentage of inorganic salts than the rarefied texture in the concave side. For example in the vertebra of Figure 1 this difference amounts to 9.65 per cent of the anhydrous substance; in that of Figure 2 to 6.2 per cent, and in another scoliotic vertebra it amounted to 8.9 per cent of the anhydrous substance. Hence, to an increase of pressure the deposition of lime salts in bone rises more rapidly than the deposition of the colloid substances. To a decrease of pressure radiography produces evidence favoring the assumption that the bone elements not only grow thinner, but that, moreover, their translucency to X-rays increases disproportionately. In representing this graphically, by noting functional pressure in the horizontal, and the formation of bone on the vertical line, we obtain two ascending lines which cross in P at a normal pressure ($= n$) (Fig. 3), the line starting from C representing the deposition of colloid substance, the one from S that of the lime salts. It may be assumed that these, like other physiological curves, have a descending as well as an ascending part, denoting that to an ever increasing pressure both the colloid substance and the lime salts cease to be deposited and start being absorbed. Moreover, it seems justifiable to assume that these descending parts will show a difference in steepness. Hence, it seems probable that to an excess of pressure ($= O$) the absorption of lime salts exceeds the absorption of the colloid substance, i.e., that a condition of *plasticity of the bone substance develops to an excess of pressure.*

Some hitherto obscure phenomena in the life of bone tissue appear as the result of such plasticity. For example the slight flattening of the femoral head in the wide (or the flat) hip-socket and the characteristic local deepening in the socket roof during the initial stage of coxa plana, i.e., long before the fragmentation stage. Also the so called "malacia" of the semilunar bone in artisans whose occupation demands forcible manual labor. A recent investigation has shown that in so called malacia of the semilunar bone other carpal bones, such as the scaphoid, the trapezium, and the trapezoid, too, may show a shortening (Figs. 4 and 5).

In 2 other cases both the semilunar and the scaphoid were found to be shortened:

I. U., carpenter, 22 years:

	Right	Left
Semilunar	7.5 mm.	8.5 mm.
Scaphoid	21 mm.	24 mm.

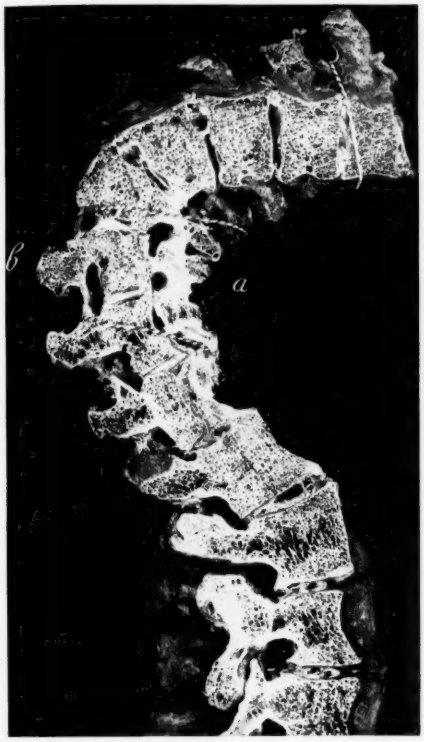

Fig. 1. For explanation regarding percentage of inorganic salts in dense and rarefied tissue of concave side of lateral curvature, see Table I.

G. S., digger, 27 years:

	Right	Left
Semilunar	8.5 mm.	7.5 mm.
Scaphoid	30 mm.	27 mm.

The dimension of these bones is reduced in the direction of the acting muscle forces without any noticeable irregularity in their structure, just as in the semilunar during the initial stage. This fact can hardly be understood unless plasticity through enhanced absorption of lime salts be admitted. It may be adequately termed *plasticity through excessive weight bearing*. As the semilunar bone is most exposed to the muscle forces which converge over both its dorsal and volar surfaces, it is the only carpal bone to undergo further deformation. At a given moment it is infracted by a forcible jerk or even imperceptibly. The

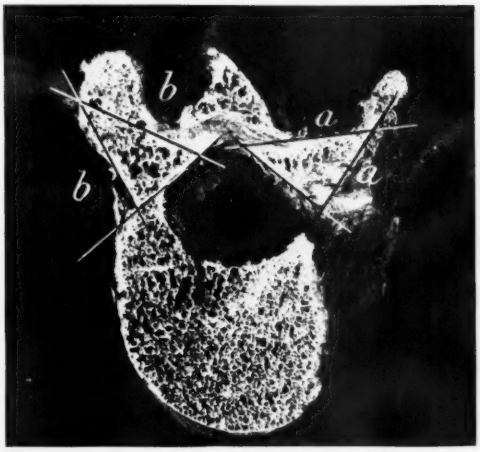

Fig. 2. For explanation see Table II.

X-ray film then shows irregularities, mostly dense transverse striæ, in the structure of the semilunar. One or more light spots are seen to develop through absorption of lime salts as is usual in the case of fractures, when the fractured ends are approached by blood vessels (Leriche and Policard). The infraction thus evokes increased plasticity and initiates a vicious circle. *Plasticity through fracture* develops on the top of *plasticity through excessive weight bearing*.

If we are right in assuming that subnormal as well as excessive functional pressure is associated with absorption of lime salts in bone, it is between these extremes that the enhanced deposition of lime salts takes place. It then follows that in cases in which increased function is demanded, this increase should be made gradual, in order that time for the additional deposition of lime salts be allowed. Thus the available evidence favors the assumption that in training for sports the skeletal parts are no less benefited than the muscles, i.e., that the bones are "trained" as well as the muscles.

Of greater importance than the rules already mentioned for the formation of bone are those for the growth of bone. In the first place there is the law of the vulnerability of rapidly growing cell groups, which, although regarding growth generally, plays an important rôle

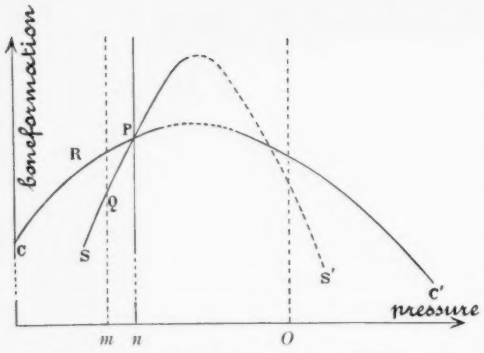

Fig. 3. The inorganic salts follow a curve *S-S'*, ascending and descending more rapidly than the curve of the colloid substance, *C-C'*. Plasticity through excessive weight bearing results, *O*. *n*, Normal pressure.

in the growth of bone tissue. This law consists of two articles:

1. Injurious agents affecting growing cell groups enfeeble their power of growth. In other words, feebleness of growth may be brought about by all kinds of injurious agents.

2. The measure in which growth is enfeebled is proportional to the rapidity of growth, i.e., the signs of feebleness of growth are proportional to the rapidity of growth.

This holds good for the parts as well as for the whole of the individual. In the individual the normal development of the muscles demands most of the power of growth, since in the adult they constitute 43 per cent of the body weight. After the musculature, the skeleton demands most of the power of growth, it forming 17.5 per cent of the body weight in the adult. And in the bones the growth discs grow fastest, since they have to procure the whole of the length increase to the bones. Therefore, in feebleness of growth it is rational to expect growth changes first in the muscles, next in the growth discs, and last in the diaphyses of the long bones.

The symptoms of feebleness of growth have been ascertained by comparing the growth of children of the same parents with regard to injurious agents they have sustained, and by doing so in a large number of families. Only such phenomena as conformed to the law mentioned were reckoned among those of feebleness of growth. Thus three degrees of growth have been established:

1. The slight degree with mere muscle weakness is characterized by the "muscle quartet": weak feet, prominent abdomen, round shoulders, blue hands and feet. It will lead to overgrowth in adolescence.

2. The severe degree, known as rickets, is characterized by severe muscle weakness. The skeleton lags behind the normal in growth; and all growth cartilages are affected.

3. The moderate degree is represented by the knock-kneed child with muscle weakness, which is neither too tall nor too small.

During recent decades the study of bone growth has been almost entirely dominated by the hormone and vitamin conceptions. A proper study of bone growth ignoring the epoch-making discoveries on the wonderful action of vitamins initiated by Sir Frederick Gowland Hopkins of Cambridge, is, indeed, inconceivable.

However, these discoveries have wrongly led the profession of our day to assume almost unanimously that rickets in children is always a vitamin deficiency. Since the most prominent scholars advocate this view, it may seem bold to oppose it. In Leiden the problem of rachitis has been approached for some length of time by a different method. Every rachitic child who came to the orthopedic department, was compared with its brothers and sisters. It appeared that a rickety child, which was found among more normal children of the same parents, was as a rule distinguished by a history of some severe obnoxious influence it had sustained. For example, infectious diseases, nutritive disturbances of the child after birth, diseases of the parents, severe hæmorrhages (placenta prævia) or fatigue of the mother during pregnancy. Moreover, in a number of cases of rachitis observed in the pediatric department, Dr. Streng was able to exclude deficiency of vitamins. Thus the assumption of the identity of vitamin deficiency and rachitis proved to be untenable. Other causes, indeed, quite apart from vitamin deficiency, appeared to be able to evoke rachitis. And the multiformity of the causes together with the uniformity of the effect constitute the essential condition for arranging phenomena among those of enfeeblement.

The enfeeblement of the body resulting from diseases and injurious agents generally, has always received due consideration from the profession. However, it has not been realized that enfeeblement of the growing body implies enfeeblement of all functions, inclusive of the essential function of growth. The result is that the symptoms of feebleness of growth have not been recognized, and pass under inappropriate names, usually taken from the Greek and Latin.

Fig. 4. G. K., cobbler of 30 years. In the left wrist the semilunar measured 9 millimeters, the scaphoid 23 millimeters, the trapezium 11 millimeters, and the trapezoid 10 millimeters; in the right wrist the semilunar measured 7 millimeters, the scaphoid 20 millimeters, the trapezium 10.5 millimeters, and the trapezoid 9 millimeters.

Fig. 5. A. W., nurse, aged 33 years. In the right wrist the semilunar measured 10 millimeters, the scaphoid 20 millimeters, the cuneiform 16 millimeters; in the left wrist, the semilunar measured 7 millimeters, the scaphoid 18 millimeters, and the cuneiform 18 millimeters.

The question arises: what is the special position of vitamins among the injurious agents affecting growth?

The experience gathered from the study of tetany, has taught that vitamin D cures tetany only if the parathyroid glands are present. If these glands are removed, the vitamins remain inactive. This furnishes ground for the assumption that vitamin D exerts its influence on calcium metabolism through these endocrine glands. And the hypothesis seems justified that the influence of vitamins on bone growth generally is an indirect one, it being directed to the endocrine glands. For example, the presence of vitamin A might be essential for the normal function of the pituitary. In other words, there is evidence favoring the assumption that the food hormones A and D are distributed from the great storehouses constituted by liver, kidneys, and other glands over the various blood glands, and stimulate these organs to produce their specific gland hormones. Hence, even in the face of the vitamin conception there is no denying the possibility that insufficiency of the function of the blood glands may be due to an enfeeblement of these glands, i.e., a primary deficiency of gland hormones as well as to a primary deficiency of food hormones. This is another reason why the identification of rickets and vitamin deficiency is not justifiable.

Hence, the improvement obtained by the administration of vitamin D in cases of rickets in which vitamin deficiency may be excluded, may be the result of enhanced stimulation of enfeebled blood glands by an extra dose of these food hormones. In this connection it may be appropriate to mention that Marfan is opposed to the identification of rickets and vitamin deficiency on the ground that, although vitamin D causes the disappearance of changes in the bones, especially those near the growth cartilages, the hypotony of the muscles, the nervous troubles and the retardation of growth improve less rapidly, and no influence is exerted on the concomitant symptoms, viz.: on the anæmia and the changes of the lymphatic system.

Two considerations reveal the importance of the dissimilarity of rickets and vitamin deficiency: First, if rachitis were, indeed, merely a vitamin deficiency, distribution on a large scale of irradiated ergosterol and its administration to young children would be the easy way of dealing with the problem of its eradication, whereas, if we are right in assuming that, apart from vitamin deficiency, rachitis may be the outcome of an enfeeblement of the power of growth, the various obnoxious agents will have to be traced and forestalled in the combat against the condition. Second, the study of rickets, if limited to the study of vitamin deficiency, largely debars us from the study of the laws of growth.

In Figures 6, 7, and 8 the three types of feebleness of growth are represented. In each of these families fatigue of the mother during pregnancy was the only injurious influence traceable. Obviously the symptoms of feebleness of growth run parallel with this obnoxious agent. In the families H. and F. there is an increased fatigue at each successive pregnancy. In the family v. d. H. the feebleness of growth increased more rapidly, the third and the fourth child being unable to survive. The mother, an energetic woman, used to sit up sewing late at night to add to her husband's small income. After the early death of the two children there is a notable improvement of the power of growth in the fifth child, which, however, decreases again with every succeeding child. Only the last child grows a little better than the previous one, the mother having had a month of rest during pregnancy.

The severe form of feebleness of growth belongs to the first years of life. Unless a chronic obnoxious influence, e.g., a chronic enteritis, keeps enfeebling the child, the condition regularly improves, even apart from treatment.

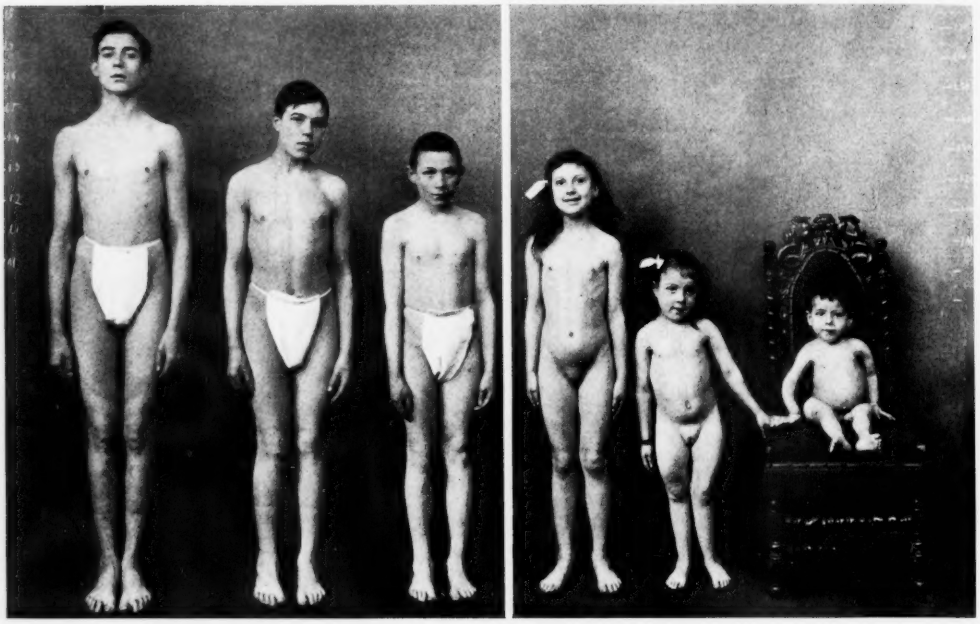

Fig. 6. Family H. For explanation see Table III.

The rachitic type usually becomes a knock-kneed child, when 4 or 5 years old. The severe degree of the first years, indeed, usually lags behind in growth throughout life, whereas the slight degree outgrows its strength mainly during adolescence. Here again there is a parallelism of the growth changes with the rapidity of growth. It is well known that in the first year the child adds 40 per cent to its length, about 13 per cent in the second, 9.7 per cent, 6.5 per cent, 5 per cent in the succeeding years, and 2.5 per cent in the sixteenth. And it stands to reason that a child being born with a certain degree of enfeeblement (necessarily inclusive of enfeeblement of the power of growth) will lag behind the normal requirements of growth less as they go on decreasing in the course of years. Hence, it is not only the parts in these three types which are affected in a degree proportional to the rapidity of their growth; but the whole body. And this strongly corroborates the view that the rickety, the knock-kneed child, and the overgrown represent three degrees of enfeeblement.

TABLE III.—FAMILY H., JANUARY 7, 1917 (FIG. 6)

Child	Age	Height—meters	Difference of height with normal of Quetelet %	Weight—kg.	Difference of weight with normal of Quetelet %	Began to walk at age—yrs.
First	17 yrs. 1 mo.	1.705	+ 9.6	56.7	+14.8	2
Second	15 yrs. 4 mos.	1.495	+ 1.28	46.0	+16.0	2
Third	12 yrs. 10 mos.	1.365	+ 0.5	37.2	+30.0	2
Fourth	10 yrs. 1 mo.	1.26	+ 5.8	26.7	+25.5	2
Fifth	7 yrs. 6 mos.	0.935	−11.4	15.6	− 5.4	5
Sixth	5 yrs. 1 mo.	0.775	−14.8	10.4	−19.4	Doesn't walk

Height of father, 1.70 meters; height of mother, 1.58 meters.

Fig. 7. Family F. For explanation see Table IV.

On this basis it is easy to complete Hueter-Volkmann's pressure rule. If in Figure 9 the dotted line represents a normal tibia, the three sloping lines represent the relative position which the growth discs of these three types occupy. Enfeebled bone, indeed, behaves in conformity with Hueter-Volkmann's pressure rule: where pressure increases, growth decreases; and reversely, where pressure decreases, growth increases. But it should be observed first that only in the moderate degree of feebleness of growth there may be both a real increase and a real decrease with regard to the normal, whereas in the severe degree even the side of the less pressure lags behind the normal, in the slight degree even the side of the greater pressure exceeds the normal, and moreover that the difference between the two

TABLE IV.—FAMILY F., FEBRUARY, 1917 (FIG. 7)

Child	Age	Height—meters	Difference of height with normal of Quetelet %	Weight—kg.	Difference of weight with normal of Quetelet %	Began to walk at age
First	17 yrs. 1 mo.	1.641	+ 2.7	52.5	− 1.3	1 yr. 6 mos.
Second*	14 yrs. 7 mos.	1.481	− 0.75	38	− 2.06	2 yrs. 6 mos.
Third	11 yrs. 10 mos.	1.327	− 2.85	28.6	− 2.39	2 yrs.
Fourth	9 yrs. 11 mos.	1.187	− 4.6	22.4	− 3.9	2 yrs.
Fifth	7 yrs. 10 mos.	1.09	− 3.77	18.0	− 4.26	2 yrs.
Sixth	6 yrs. 2 mos.	1.055	− 7.62	18.2	+ 4.0	2 yrs.
Seventh	5 yrs. 1 mo.	0.963	− 1.6	15.4	+ 5.8	2 yrs.
Eighth	2 yrs. 11 mos.	0.758	−11.6	10.2	−17.0	Cannot stand
Ninth	1 yr. 5 mos.	0.631	−14.4	6.3	−38.0	Cannot stand

Height of father, 1.75 meters; of mother, 1.518 meters.
*Photograph could not be obtained. Child has knock knees—distance between ankles, 5.5 centimeters.

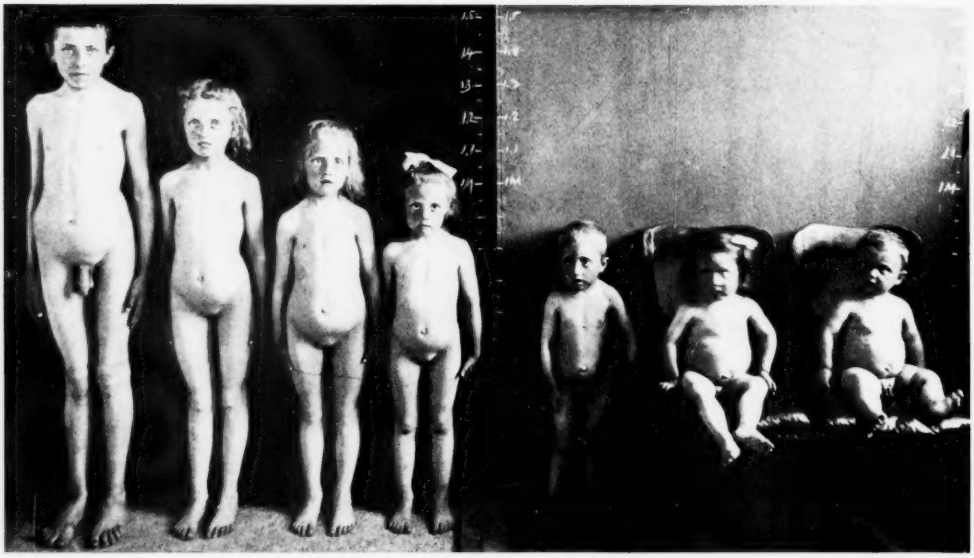

Fig. 8. Family v. d. H. For explanation see Table V.

sides becomes less in proportion as the degree of enfeeblement approaches the normal.

In the normal subject, on the contrary, a moderate increase of functional pressure is associated with an increase of growth: the normal child as a rule starts its first steps with bow-legs. The fact that these legs grow straight signifies that the mesial side of the greater pressure grows more quickly than the lateral side. Normal bone substance disposes of a certain reserve power of growth to an increase of pressure. And the spontaneous straightening of slight knock-knees in children, which is observed when causes for temporary enfeeblement disappear, and more generally, when the bodily condition comes nearer the

TABLE V.—FAMILY v.d.H., JUNE 4, 1917 (FIG. 8)

Child	Age	Height—meters	Difference of height with normal of Quetelet %	Weight—kg.	Difference of weight with normal of Quetelet %	Began to walk at age
First*	13 yrs. 2 mos.	1.51	+ 5.8	35.2	+ 0.28	14 mos.
Second	11 yrs. 9 mos.	1.302	− 2.76	24.7	−14.5	1 yr. 6 mos.
Third†	—	—	—	—	—	—
Fourth‡	—	—	—	—	—	—
Fifth	7 yrs. 9 mos.	1.191	+ 5.58	21.0	+12.3	1 yr. 6 mos.
Sixth	6 yrs. 4 mos.	1.075	+ 2.48	16.7	+ 1.2	1 yr. 6 mos.
Seventh	5 yrs.	0.07	− 8.1	11.5	−27.2	3 yrs.
Eighth	3 yrs. 3 mos.	0.775	−10.8	10.5	−13.2	3 yrs.
Ninth	1 yr. 9 mos.	0.735	− 4.3	10.7	− 0.9	Does not walk

Height of father, 1.682 meters; of mother, 1.572 meters.
*Mother used to sit up late at night sewing in order to add to husband's small income. She had had a rest at sixth month of pregnancy during attack of appendicitis.
†Died at age of 5 months.
‡Died at age of 3 weeks.

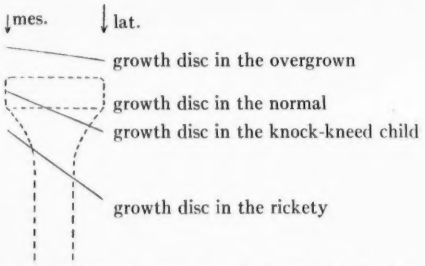

Fig. 9. Position of upper growth disc of tibia in the enfeebled as compared with the normal (schematic).

normal, is to be considered as the outcome of the restoration of the normal reserve power of growth.

It needs no comment that the uninterrupted lines obtained in Figure 9 are parts of as many physiological curves which have an ascending as well as a descending portion. We have represented them in Figure 10 by completing them by dotted lines. In this figure pressure has been noted on the horizontal, growth on the vertical line. In curve I of normal growth the reserve power of growth has been represented by a rise of the curve even after the pressure exceeds the normal, *n*. In slight feebleness of growth (curve II) there is no reserve power of growth: any exertion exceeding the normal tends to the development of knock-knees in the overgrown. The overgrown errand boy, for example, will develop knock-knees, especially if he has to carry heavy parcels. This phenomenon is indicative of *enhanced fatigability* of the growth discs near the knee. On the other hand, the fact that the top of curve II rises higher than normally, indicates their *enhanced irritability*. Those two properties of enfeebled bone substance are still more pronounced in curve III, which represents severe feebleness of growth. It ascends and descends steeper than curve II and turns round to still less pressure. These curves lay no claim to mathematical exactitude. Yet they may tend to show that Hueter-Volkmann's pressure rule, which is represented by *a-b*, is concerned with only one out of many possibilities. Moreover, they may show the characteristic properties of enfeebled tissues, viz.: enhanced irritability and enhanced fatigability.

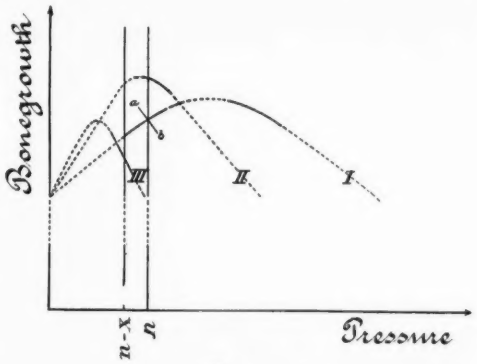

Fig. 10.

Very instructive with regard to the growth changes in severe feebleness of growth is the X-ray of the rachitic hand (Fig. 11). In the first place it is smaller than the normal hand, as is the rachitic body as a whole. When enlarged to the size of the normal hand of the same age (Fig. 12) we are struck by the fact that the metacarpals are shortened far more than the fingers. And among the metacarpals the first and fifth are still more retarded than the others. It will be realized that the proximal bones of the hand are exposed to greater muscle forces than the distal ones, and the first and fifth metacarpals to extra stresses from thenar and hypothenar. So the bones of the rachitic hand show a retardation of growth which is proportional to the pressure they have to resist, as is represented in the descending portion of curve III in Figure 10.

But there is more: the bone centers in the epiphyses of the metacarpals and in the carpal bones are smaller than normal even in the enlarged hand of Figure 12. This means that the transition of cartilage into bone is retarded even more than the growth of the bones as a whole. And if this transition into bone is called differentiation, we may say in severe feebleness of growth differentiation shows extra retardation.

It lies beyond the limits of this address to deal with all phenomena of feebleness of growth. Yet the thickening of the growth cartilages, observed in the severe form, which more than any symptom of rachitis has drawn the attention of the profession, demands men-

Fig. 11. C. H. Five years, 8 months old.

Fig. 12. W. H. Five years, 5 months old.

tion. The normal growth cartilage presents, side by side, three areas: one of division of cartilage cells, one of enlargement of cartilage cells, one of differentiation. Now the microscopic examination of a number of growth discs taken from children who had died at the same age, but from different causes, has furnished grounds for the assumption that in feebleness of growth the three processes are retarded, respectively arrested in reverse order, i.e., differentiation first and most severely, cell enlargement next, cell division last and least severely. All the symptoms these growth cartilages presented, thus seemed to find an explanation in the assumption that in this reverse order they are processes of successively decreasing rapidity of growth. Hence we are forced to ascribe the thickening of the growth cartilages in rickets to an extra retardation of differentiation as is more directly noticeable in the short bones. In other words in severe feebleness of growth, differentiation behaves as a process of more rapid growth than cell division and cell enlargement.

Summarizing, we recognize four grounds for the assumption that the rachitic, the knock-kneed child, and the overgrown are to be considered as three degrees of enfeeblement, inclusive of feebleness of growth, viz.: (1) the fact that they may be brought about by any injurious agent; (2) that in these conditions the parts of the body are affected in a degree which is proportional to the rapidity of their growth; (3) that their body as a whole is equally subject to the law of the vulnerability of rapidly growing cell groups; (4) that bone growth in these conditions shows the properties characteristic of enfeeblement, viz.: enhanced irritability and enhanced fatigability.

Time does not allow me to sketch in detail either the disturbances of the locomotor apparatus which the enfeebled have to endure from the cradle to the grave—weakness of the feet, enlarged veins and their sequelæ—or the affections to which the tissues outside the locomotor apparatus are prone. Yet, a few salient features must be mentioned. The epithelial coverings of the outer and inner body surface show a tendency to eczemata and catarrhs; the nervous system invariably shows enhanced irritability and fatigability; the adenoid tissue tends to enlargement. All these symptoms again are worst in the first years of life and gradually diminish, without, however, disappearing altogether. Infectious diseases are more frequent and adopt a more serious

aspect in these than in normal individuals. Poliomyelitis takes its victims almost exclusively from among the enfeebled. And the narrow limits of tolerance to the anæsthetic these patients show during an operation are in agreement with the enhanced irritability and fatigability of their nerves. In proportion as the muscle weakness is greater, i.e., in moderate feebleness more than in the slight degree, the abdominal wall will perform less well its function as a suction and force pump for the circulation of the blood in the organs for digestion, and abdominal affections will more frequently require treatment of physician and surgeon.

Thus by the study of the quantitative growth changes in the locomotor apparatus, orthopedics has drawn the picture of the *feeble constitution*. This constitution is nothing but a quantitative deviation from the normal life processes. It presents itself in three degrees with all imaginable transitions between total lack of the power to grow, or even death, and normal strength. It develops from normal life according to simple laws and rules.

In medical literature many a type of constitution has been pictured in which phenomena of enfeeblement play a rôle, such as status hypoplasticus (Rokitansky, Bartel), asthenia (Stiller), status thymicolymphaticus (Paltauf), exudative diathesis (Czerny), insufficiency of the fibrous tissue (Bier), hypotony (Tandler), lymphatism (Stoerk). The large number of these conditions proves on the one hand how great the need is of a proper constitutional insight, and on the other hand that the grounds for unity in this insight fail. In none of these pictures has the development of the phenomena been traced in conformity with biological laws or rules. In none are grounds brought forward that will enable one to discriminate between quantitative and qualitative changes, urgent though this be. The quantitative changes, indeed, do not necessarily occur in the ancestors, they are not necessarily hereditary; the qualitative changes, on the contrary, are. They obey Mendel's laws. And, what is most important, the quantitative changes may often be forestalled, the qualitative cannot. Therefore it will be useful to learn whether the phenomena designated by these various constitution types, obey the law and the rules to which feebleness of growth is subject. A beginning has been made in Leiden. From our study it seems probable that different symptoms of Czerny's exudative diathesis are the outcome of an enfeeblement of skin and mucous membranes; that the nervous system of the enfeebled enhances the chances of hypertony and hypotony; that of Paltauf's status thymico-lymphaticus the excessive length growth, the narrow aorta, the persistent thymus, the enhanced liability to suicide are intrinsic of the slight degree of feebleness of growth.

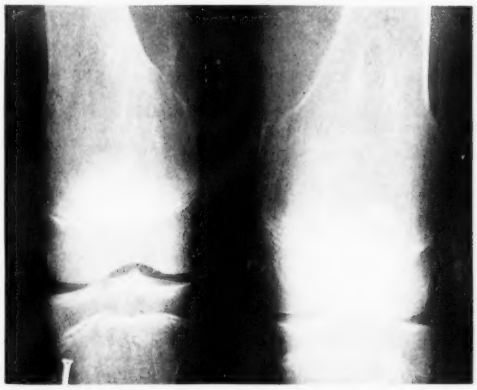

Fig. 13. Roentgenogram showing lengthened metaphyses.

The obstetrician, the pediatrician, the physician, the surgeon, the ear specialist, the neurological and psychiatric specialist who by a glance at the locomotor apparatus of their patients will learn to estimate the degree of their patient's weakness, will derive valuable data from this estimation, sometimes enabling them to determine the cause, often the nature, and even the method of treatment of the condition they are to deal with. The laws and rules which prevail in the development of the locomotor apparatus, may serve them as working hypotheses for the solution of the more intricate problems the internal organs present. This is a service which orthopedics has rendered to the medical sciences in return for what she owes to them.

Extra retardation of differentiation, as observed in severe feebleness of growth, presents itself in other forms of dwarf growth, regardless of the cause, provided there be no complete arrest of growth, e.g., in myxœdema and achondroplasia. It is one of the forms of dissociation of the processes of bone growth affecting the whole skeletal system symmetrically, a systemic dissociation. In Ollier's dyschondroplasia each of the various processes of bone growth may be seen to dissociate itself from the other processes of growth, locally, each giving rise to the development of a characteristic phenomenon, for example, enchondromata, exostoses, lengthened metaphyses (Fig. 13). In dyschondroplasia the cause is

probably a local one and is connected with the blood vessels. Hence, dissociation is a familiar occurrence in the life of the bone substance. In preformed bone the behavior of inorganic salts with regard to that of the colloid substance, as described in the early part of this paper, may be considered as a form of dissociation under the influence of variations of functional stresses. And even the brittleness of bones living under enhanced hydrostatic pressure, as in œdematous conditions, is possibly the outcome of the same process.

The application of the laws of growth together with mechanical data constitutes the *biomechanical method of research* characteristic of orthopedics. Besides designating the phenomena of enfeeblement and creating the picture of the feeble constitution in three degrees, it has enabled us to determine the nature of a number of congenital malformations, to arrange them in chronological order and *per exclusionem* to designate smallness of the amnion as their cause.

Thus orthopedics has made a beginning in creating order in a large domain of teratology, but much important work remains to be done.

In a most fascinating study published in 1921, Charles R. Stockard corroborated the law of the vulnerability of rapidly growing cells by proving with remarkable experiments that "all varieties of defects may be induced by subjecting the embryos to one and the same experimental treatment, viz., by lowering the temperature or by diminishing the available supply of oxygen. The organs which are in their most rapidly proliferating condition, are affected, those which are developing at a slow rate, are not."

Moreover, the laws of growth serve as a guide to treatment. They make us understand why, for example, lateral curvature is liable to develop in the first years of life, especially in weak children, and why in that period of rapid growth the condition is amenable to improvement, whereas in the tenth year, when growth is ten times as slow as in the first, or in the sixteenth year, when growth is sixteen times as slow, unduly powerful measures are required for improvement.

Likewise, we can predict what changes are apt to develop in hip joints with congenital incongruity, whether coxa plana, coxa valga, and slipping epiphysis or malum coxæ.

The most important conclusion which the laws of growth render justifiable, is that the rapidly increasing number of overgrown adolescents in different nations bespeaks enfeeblement. And with a view to the future of such nations it is urgent that the causes of this enfeeblement be traced and forestalled.

But for the law of the vulnerability of rapidly growing cells it might be imagined that only such obnoxious agents will lead to enfeeblement of the children as enfeeble or exhaust the parents in like degree. However, in this regard it has been observed that the fetus is affected far more seriously than is the mother by fatigue during pregnancy. The mother shows no change whatever after delivery, whereas the child, affected during the whole period of its development by the same injurious agent, appears to have sustained a considerable reduction in its power to grow.

The law of the vulnerability of rapidly growing cells thus introduces a new factor in estimating the effect of injurious agents which act on prospective mothers, a factor which has also bearing on prospective fathers. Indeed, it should be remembered that in the adult male the sex glands are in more active cell division than are all other organs, the latter being largely confined to the maintenance of metabolic balance. This has become evident from the sensitiveness of these glands to X-rays, and possibly also from the inordinately rapid growth of tumors of the testicles. In this connection it is of importance to mention that Levaditi observed that his neurovaccine produced pustules by preference in the ovaries and testicles of test animals and in areas of skin where, by pulling out the hair, active cell division had been evoked. In short, it is beyond doubt that in the male sex glands and probably in less degree also in the female germ glands, the normally active cell division renders these organs more vulnerable than the other parts of the body. And it should be kept in mind that injurious influences which have no noticeable ill effect on any of the organs of the adult, may imperceptibly injure the sex glands and enfeeble the inscrutable potentiality of the germ cells.

At the risk of seeming presumptuous I venture to state that just as bacteriology and

parasitology were destined to reduce disease by which mankind was decimated, so orthopedics seems to be destined to teach the methods of forestalling the enfeeblement of our race. At all events the aforesaid may suffice to show that orthopedics has to a certain extent risen from a stage of empiricism into that of a science it being, at least partly, founded on laws and rules.

If it is true that a science attains social importance as soon as it becomes beneficial to many, the above may have contributed to establish such importance of orthopedics. So far, moreover, this has been done on a large scale by the practice of orthopedics, which culminated during the great war, when 30,000 beds were occupied in England by orthopedic patients. The recognition of the true nature of a number of morbid conditions and the application of most ingenious modes of treatment meant enhancement of efficiency to thousands and thousands both in peace and in wartime. The share the Liverpool School of Orthopedics had in this work, is well known. And it must here be stated that hardly any orthopedic condition can be named in which the two great orthopedic leaders of this school have not made their contribution by adding manipulations, operations, or appliances to the armamentarium of the orthopedist.

Because of the humanitarian spirit which has developed during the twentieth century, orthopedics has extended its social task by striving for the eradication of crippledom. Through the great help of charitable lay people, a wide social scheme of prevention, location, treatment, after-care, education, vocational training and placement service has developed, the beneficent influence of which is felt throughout the world. In this service wealth, science, technical skill, and self-sacrifice have joined hands. And in the annals of mankind it may be noted with golden letters that to the English speaking nations the honor is due of having given most in voluntary aid and charitable work.

Thus orthopedics by harmonious co-operation of charity and science, is leading the way to greater bodily efficiency and a stronger posterity to all those who are willing to obey the laws of nature.

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HISTOGENESIS AND TENDENCY TO BILATERALITY OF PAPILLARY OVARIAN CYSTS[1]

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EVERY embryological and histological structure in the ovary, except the lymphatic vessels and the nerves, has been considered, hypothetically, to be the origin of papillary cysts (1 to 9, 11, 12, 14 to 24). The cysts also have been said to arise from misplaced remnants of tubal epithelioma (10, 13, 22) (which is derived from the same primordial germinal epithelium as that of the surface of the ovary). Many of the hypotheses, however, are no longer tenable, and in general modern authorities accept one or two of the three that follow: (1) that they develop from the germinal or surface ovarian epithelium which includes its invaginations, tubules, and small cortical cysts; (2) that they develop from the graafian follicles; or (3) that they develop from the rest of the ovary (wolffian tubules).

Both ovaries of a given subject are often observed in the pathological laboratory, the one bearing a papillary ovarian cyst and the other appearing grossly normal. In such cases the surgeon has removed both ovaries because of his knowledge of the danger to the normal ovary.

In an attempt to explain this tendency to bilateral involvement of the ovaries, authors have mentioned actual contact of the two ovaries, implantation, metastasis through the retroperitoneal lymph spaces, and independent development of the condition in the two ovaries from intrinsic structures. This last explanation seems most plausible, because, if the ovarian tumor is intracystic, that is, has not broken or ruptured through its outer cystic wall, actual contact of the two ovaries, or implantation, could not explain the bilateral involvement. In regard to metastasis from one ovary to the other by means of the retroperitoneal lymph spaces, it seems logical to conclude that this rarely occurs, because other evidences of metastasis by the lymphatics are uncommon in this type of tumor.

Thus, the premise was taken that the tumors, when bilateral, develop independently of one another, and a study was undertaken to determine the incidence of occurrence, and the origin, of any potentially pathological structures or beginning ovarian tumors which could be found in grossly normal ovaries which had been removed at operation, together with intracystic papillary ovarian cysts of the opposite ovaries. Eighteen suitable specimens were studied. For a control group 50 cases were selected at necropsy and at operation in which both ovaries were grossly normal; one ovary was studied in each case. The average age of the patients of both groups was between 45 and 50 years.

Each ovary was cut into three blocks of equal size, and from each block three microscopic sections were made at equidistant levels, thus affording a representative histological picture of the entire organ. If structures of interest were found, serial sections were then made.

We shall consider the two groups of cases together because of the morphological similarity of structure. A few important differences in the two groups will also be considered.

RESULTS

The germinal or surface epithelium and its structures were complex. The usual type of surface epithelium was cuboidal, but in ovaries at the age of the patients from whom the tissue studied was derived, superficial and deep crypts or indentations are often observed; in the deep indentations, particularly, the epithelium often became columnar in type (Fig. 1). In the vicinity of these indentations (although occasionally isolated), tubules could be observed which were lined by epithelium similar to that of the indentation and when traced by serial section it was noted that the more superficially placed the tubule, the more likely it was to be connected with an indentation.

[1]Abstract of thesis submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery, 1931.

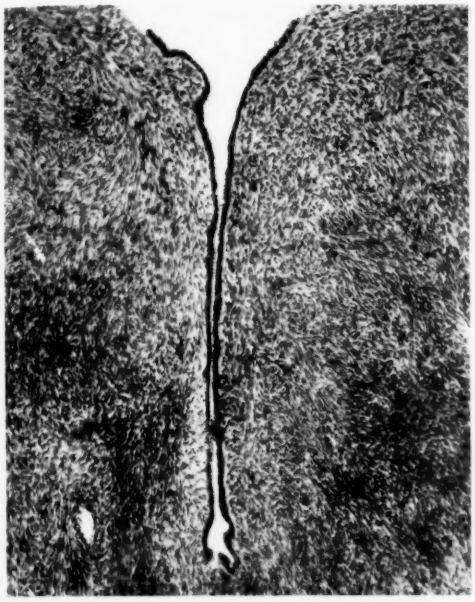

Fig. 1. A deep surface indentation lined by high columnar epithelium.

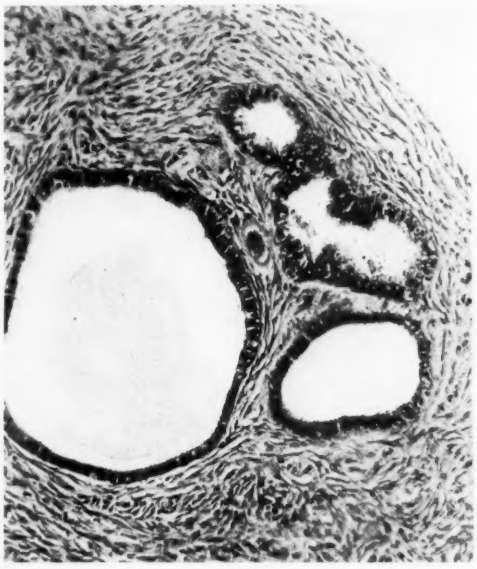

Fig. 2. A small group of epithelial structures in the cortex lined by high columnar epithelium; the surface epithelium is missing, probably the result of trauma. (×100.)

The germinal epithelial structures of most interest were the microscopic cystic structures commonly found in the cortex (Figs. 2 and 3). They were single or in groups, with a varying number of tubules. Their lining might be of a columnar, ciliated type, similar to that observed in papillary ovarian cysts. However, a part or all of the epithelium of these structures might be of a cuboidal or flat type, particularly in the larger cysts. By serial section these structures were rarely found to have any connection with an indentation and maintained approximately their same relative position in the cortex when traced through their entire course, which varied from 50 to 1,500 microns or more. The tubules of the group often anastomosed with the microscopic cystic structures or dilated into cysts. Not rarely a cystic structure was found which contained material that gave a positive reaction for mucin, and degenerative changes were not uncommon, as exemplified by deposits of calcium (psammoma bodies) replacing the small structures. A small cystic structure often was found just beneath the epithelial covering of the ovary; it appeared as a minute vesicle, and in many instances was called a subserous cyst.

It would appear, from these observations, that the structures had as their progenitors the epithelial tubules which had pinched or

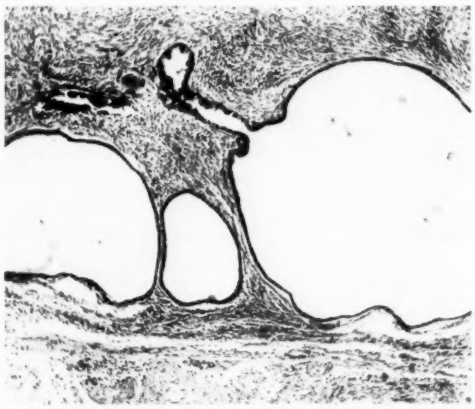

Fig. 3. A group of cortical epithelial structures showing a tubule which communicated for a short distance with a small microscopic cyst. (×38.)

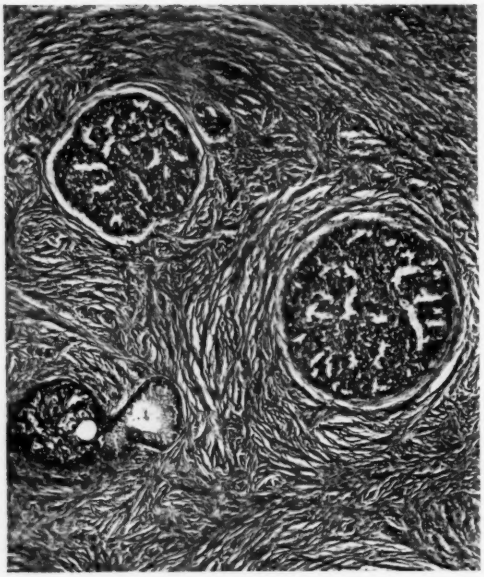

Fig. 4. Early carcinoma found deep in the cortex of a grossly normal ovary; the opposite ovary was replaced by a large intracystic papillary ovarian cyst. One of the structures merges into an epithelial tubule lined by goblet cells.

budded off from the surface indentations of the germinal epithelium, or had resulted from incomplete atrophy of the germinal epithelial structures in the embryonic ovary (7).

In comparing the epithelial structures as found in the two groups of cases certain significant differences were noted:

1. In the grossly normal ovaries each of which was one of a pair removed because there was an intracystic papillary cyst in the opposite ovary, these cystic structures were usually abundant and found in all cases. On the other hand, in the normal control group these structures were usually not so abundant and were observed in only 64 per cent of the cases.

2. Definitely beginning tumors were found in 2 of the grossly normal ovaries which had been removed because there were papillary cysts in the opposite ovaries. One tumor, an early carcinoma (Fig. 4), consisted of a group of solid epithelial structures found in the cortex, and by serial section one of these structures was seen to merge into an epithelial tubule lined by goblet cells. Many groups of the small, cortical, epithelial cystic structures were found in this ovary, and it is from these that the carcinoma undoubtedly took its origin, the cells undergoing carcinomatous hyperplasia. The second specimen revealed three small, cystic cavities in the medulla of the ovary; their walls were roughened, due to papillary ingrowths, as was shown by microscopic examination (Fig. 5). The lining of these small cystic cavities was for the most part of a high columnar, ciliated type of epithelium, similar to that observed in the several small groups of epithelial cystic structures in the cortex. These cystic cavities undoubtedly were beginnings of intracystic papillary ovarian cysts which developed from some deeply placed cortical epithelial cystic structures, and which, as they grew, expanded in the direction of least resistance. It is noteworthy that the rete of the ovary was found as an inconspicuous structure in the medulla, near the hilum, and that it did not show any connection with the beginning intracystic papillary ovarian cyst.

3. Superficial papillomata were observed in 8 per cent of the specimens in the control group and in 15.7 per cent of the grossly normal ovaries which were found associated with an intracystic papillary ovarian cyst of the opposite ovary. Their appearance was characteristic and was in contrast to the surrounding cuboidal surface epithelium; all except one was covered at least in part by high columnar non-ciliated epithelium similar to that of the small cortical epithelial cystic structures. In several there were indentations of the surface epithelium into the stroma, and in one specimen (Fig. 6) an indentation communicated with a small cystic structure lined by columnar epithelium. This is significant in that the opinion gained from the microscopic data in these two groups of cases corroborates that of Williams, Gottschalk, Hofstætter and others that there is a definite relationship between the superficial papilloma and the papillary ovarian cyst.

4. It has been proved that a papillary ovarian cyst may arise from a graafian follicle, but in this study nothing to suggest this was found, and in only 2 instances could a possible relationship with the small, cortical, epithelial cystic structures be cited. In the group of

Fig. 5. A beginning intracystic papillary ovarian cyst in the medulla of a grossly normal ovary; the opposite ovary was replaced by a multilocular intracystic papillary cyst. (×70.)

grossly normal ovaries which were removed with intracystic papillary ovarian cysts of the opposite ovary, two ovaries contained small, round, cortical, cystic structures lined by nonciliated columnar epithelium. Both of these structures suggested origin from graafian follicles, because the surrounding cellular tissue contained a few cells which appeared as theca lutein cells.

5. The rete of the ovary was found in 78.9 per cent of the group of grossly normal ovaries removed with an intracystic papillary cyst of the opposite ovary and in 86 per cent of the normal control group. Usually they occurred as two or three inconspicuous groups of tubules near the center of the medulla in the third of the ovary nearest the hilum, although in three specimens the tubules near the hilum were numerous, giving an adenomatous appearance. An instance was not found to suggest a connection between the rete of the ovary and the cortical epithelial structures. The epithelial lining of the rete of the ovary was usually of a columnar type with cilia, and from the

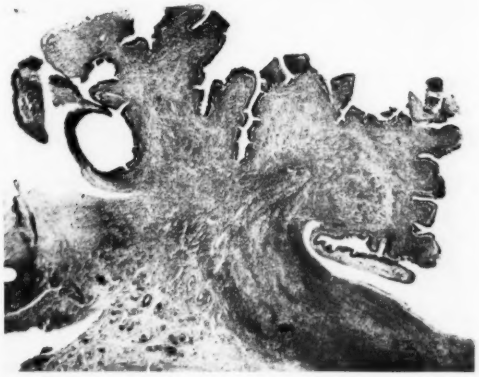

Fig. 6. Small superficial papilloma of the ovary. The high columnar epithelial covering with the many indentations and the small cystic structure communicating with one of the indentations may be noted. (×20.)

appearance one would immediately suspect them of being the parent structures of the papillary ovarian cyst. However, only a few cases have been reported in support of this hypothesis of origin, which will stand scientific criticism.

SUMMARY

A review of the observations is as follows: the small, cortical, epithelial cystic structures were found in 100 per cent of the grossly normal ovaries which were removed with intracystic papillary ovarian cysts of the opposite ovary, whereas in the normal control group the structures were found in only 64 per cent of the cases. These structures are undoubtedly of germinal epithelial origin. Two of the grossly normal ovaries which had been removed with an intracystic papillary cyst of the opposite ovary showed definite beginning tumors: an early carcinoma, and a papillary ovarian cyst. Both appeared to have originated from the small, cortical epithelial cystic structures despite the fact that one (the beginning papillary ovarian cyst) was situated in the medulla. The superficial papillomata were found about twice as frequently in grossly normal ovaries which had been removed with intracystic papillary ovarian cysts of the opposite ovary, as in the ovaries from normal controls. From the microscopic appearance it is apparent that these structures are closely related to the

papillary ovarian cysts. In this series of cases very little evidence was obtained to indicate that the graafian follicles or the rete of the ovary are frequent sources of origin of the papillary ovarian cyst.

Thus it may be stated (1) that most papillary ovarian cysts probably develop from the small germinal epithelial cystic structures found in the cortex of the normal ovary, and (2) that the grossly normal ovary which is found in association with an intracystic papillary ovarian cyst of the opposite ovary is a potential danger and should always be removed, age permitting.

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CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, TEMPLE UNIVERSITY

A TECHNIQUE FOR VAGINAL HYSTERECTOMY

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IT is my purpose to discuss the vaginal approach in operating upon the pelvic organs, as I believe that this route is not receiving the attention that it deserves.

The posterior uterine cul-de-sac is separated from the vagina by tissues only a few millimeters in thickness. This thin partition is easily punctured or divided, thus giving the quickest and probably the safest access to the pelvic cavity in women. With the patient in the Trendelenburg position and with the use of appropriate trowels and other retractors, the pelvic cavity may be explored by direct vision. The ovaries and tubes or the fundus uteri may be pulled down into the vagina, examined, and treated radically or conservatively. Pedunculated or interstitial tumors may be removed from the uterus, ovarian cysts evacuated, delivered, and removed, and large solid tumors morcellated and extirpated. Not infrequently the vermiform appendix may be seen and even removed. For many years, we have used this approach in operating for ectopic pregnancy. As the cul-de-sac is freely opened, there is a gush of blood, the finger locates the diseased tube, which is seized, pulled into the vagina by sponge forceps, and either clamped or ligated. A gauze pack is placed in through the opening in the cul-de-sac, and the operation is over. The time required has been less than that required to sew up an abdominal wound. As a diagnostic measure the cul-de-sac incision should be considered.

As for vaginal hysterectomy, while it has been enthusiastically praised by a small group, it has never become widely popular. Many abdominal surgeons never use it. In some of the surgical centers it is hardly ever mentioned. Is it because it is not a safe operation for the patient, or because it may impose operative difficulties on the surgeon? Or is it that we follow the operation to which we become habituated, and find it inconvenient to select from a variety of methods when a single routine one will serve the purpose?

Surely, the vaginal route is not avoided to protect the patient. I doubt if as low a mortality can be obtained by any abdominal method of hysterectomy. The statement of Pryor,[1] in 1903, that vaginal hysterectomy has no mortality, while, of course, not absolutely accurate, indicates a not unusual experience; and may be compared with the very low mortality attained with this operation by Joseph Price and J. W. Kennedy. In a personal experience of over 300 vaginal hysterectomies, over 50 per cent of which were done for fibromyomata, there have been no deaths, when the operation was done for non-malignant disease, since 1914. During this period, about 200 vaginal hysterectomies have been done with the technique to be described. In recent years especially, the continued low mortality and morbidity have caused us to turn more and more to the vaginal extirpation. In a series of 107 cases before 1914, during a period when insulin was unknown, and when clamps or mass ligation often with vaginal closure were used, there were 4 deaths, and a number of postoperative hæmorrhages or localized pelvic infections occurred. The present rather simple technique has largely eliminated these dangers.

I feel very sure, considering the types of patients selected for the vaginal operation, that a mortality of less than one-half of one per cent would not have obtained had I resorted to supravaginal hysterectomy, or especially to complete abdominal hysterectomy. The patients were for the most part elderly, a large number were obese, not a few were markedly anæmic from hæmorrhages.

The chief indications for the operation have been hæmorrhage and tumor. Over 80 per cent of the fibroid tumors treated by hysterectomy were removed through the vagina. Certain of the tumors reached to or slightly above, the navel. The exertion expended in the morcellation of certain of these large, hard fibroids is consider-

[1] Text Book of Gynecology.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. Vaginal hysterectomy. A preliminary episiotomy, which is rarely as extensive as that which is indicated by the dotted line, is occasionally desirable in order to obtain adequate access with a nulliparous or narrow atrophic vagina.

Fig. 2. The extensive incision of Schuchardt is necessary only in rare cases as when the vaginal hysterectomy is done for malignant disease.

Fig. 3. The operation of vaginal hysterectomy begins with an elliptical incision encircling the cervix at the cervicovaginal reflexion. If the uterus is very large the incision should extend well laterally.

able. Fortunately, the patient is less affected than the surgeon, and in no case has it been necessary to open the abdomen. With care, adhesions to intestine or omentum may be brought down, divided, and ligated under guidance of the eye. The operation should not be a blind one. Every step should be visible; but the operator must accustom himself to the small wound field and be satisfied with seeing only the small area where he is working.

One patient had adhesions between the fibroid and the navel, one had adhesions from a previous ventral suspension. Intraligamentous fibroids are very accessible by the vagina, and the softness of cystic fibroids does not prevent their morcellation and extraction, contrary to the statements of earlier writers. One patient had gone about bleeding daily for over 2 years, finally with the hæmoglobin 22, and with the red cells numbering 1,700,000. A fair sized fibroid hung from the vagina, attached to a completely inverted uterus.

Forty-three hysterectomies were done for hyperplastic or fibrotic uteri, without tumor, having as the most common symptom excessive hæmorrhage about the time of the menopause. If we can practically eliminate the mortality from vaginal hysterectomy, then it may properly compete against the use of diagnostic curettage and radium on the basis that it more surely eliminates the possibility of lurking or of later malignancy, and that it is not followed by relapse or radium neuritis.

In over 13 cases, the hysterectomy was complicated by ovarian tumors which were removed through the vagina. Of these, there were 9 ovarian cystomata, 2 ovarian dermoids, 1 ovarian fibroma, and 1 suppurating ovarian carcinoma. Carcinoma was present in the vagina in 1, the corpus uteri in 2, in the cervix in 8 cases.

In one carcinoma of the cervix the left ureter required dissection. Vaginal hysterectomy, however, is not advocated for well developed carcinoma of the cervix. In certain selected cases of adenocarcinoma of the fundus, by first carefully curetting the uterus and packing the cavity with gauze thoroughly wrung out of zinc chloride solution to prevent dissemination of malignant cells, the vaginal extirpation may be attempted, provided the uterus can be removed without morcellation. We do not favor the opening of the cancerous uterus during its delivery. For example, in the case of a very anæmic and obese virgin of 61 years,

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 4. The anterolateral margins of the vaginal incision are retracted by a narrow trowel, thus exposing the lower branch of the uterine artery which is ligated and divided first upon one side and then the other.

Fig. 5. Under traction the uterus starts to descend and with a few snips of the scissors laterally the main trunks of the uterine vessels come into view and are also individually ligated, divided, and the pedicles retracted by the edge of the trowel. Posteriorly as the uterosacral ligaments are divided the posterior cul-de-sac is opened and a narrow pad with attached tape may be introduced into the pelvis. The uterosacral ligaments may or may not be ligated.

Fig. 6. Unless fixed by size or adhesions the uterus may now be partially withdrawn from the vagina and the lower loops of the ovarian vessels are exposed, ligated, and divided close to the uterus. At this stage the anterior cul-de-sac is often opened, but no special attempt is made to do this or to separate the bladder from the uterus in the midline. By progressive liberation and ligation laterally, keeping close to the uterus the peritoneum at the anterolateral face of the uterus will be entered without difficulty and by proper retraction by the trowel the bladder and ureters will be held out of harm's way.

with very poor myocardium, it seemed better to face the very definite operative difficulties of the vaginal route, than the forlorn chance of recovery from a complete abdominal hysterectomy.

In the entire series, a procidentia was present in over 22 patients. In 2 of them, there was a secondary prolapsus of the vaginal walls after the hysterectomy. Of course, hysterectomy alone is an insufficient operation for a prolapsed uterus. No vaginal hernia in a patient without preoperative prolapsus has been observed in our series.

A perineorrhaphy of the submucous type was associated with the hysterectomy in 46 cases. In about 35 patients, the appendix was also examined and removed through the vagina.

The treatment of the appendages has varied. As a rule, the tubes were removed even though not diseased to prevent a postoperative mucous sinus of the vaginal vault. In patients before the menopause, an attempt was made to save at least a part of one ovary.

TECHNIQUE

The patient is shaved, the vagina is thoroughly cleansed, and a folded sterile towel or thick pad is fastened by towel clip over the anus. With the patient in the high lithotomy-Trendelenburg position, a weighted posterior vaginal speculum is introduced, the cervix is dilated, and the uterine cavity is packed with a narrow strip of gauze wet with 3.5 per cent tincture of iodine. If intrauterine sepsis is present, the intra-uterine packing is carefully wrung out of a saturated solution of zinc chloride, and the vagina is then cleansed with tincture of iodine. The cervix is firmly grasped with strong volsellum forceps, pulled down, and encircled at the cervicovaginal fold, by a scalpel. The cervix is then pulled strongly downward and to the right, while the left upper margin of the incision and bladder are retracted and lifted upward by the edge of a narrow trowel. With a few touches of the scalpel or scissors, the lower loop of the uterine vessels is exposed and ligated close to the cervix by No. 1 plain catgut carried by a small curved needle. As the vessels are divided medial to the ligature and the pedicle and parametrium are pushed up and lateral by the edge of the trowel, the uterus begins to descend under traction. Pulling the cervix down and to the left, with a few snips of the scissors, the right lower uterine vessels are also exposed, ligated, and then divided close to the cervix. With traction somewhat forward, first to the left and then to the right,

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. If the uterus is not unduly large, the fundus may now be grasped and delivered.

Fig. 8. The fallopian tubes may be removed with the uterus, one or both ovaries being retained if desired.

Fig. 9. The fallopian tube has been separated from the ovary, the round ligament has been clamped and divided preparatory to ligation.

the left and right uterosacral ligaments are demonstrated, ligated, and divided. Under the firm traction there usually follows a decided descent of the uterus into the vagina. With division of these ligaments, the peritoneum is also opened. A narrow trowel is carried through the peritoneal opening, the uterus is lifted forward, and a narrow pad with attached tape is carried high into the pelvis to wall off the intestines and to absorb wound secretions. If there is free bleeding, which is unusual, the vaginal and peritoneal margins are united by sutures.

The partially mobilized uterus is again pulled strongly down and to the right, and the bladder and upper vaginal margin is pushed upward and to the left by the trowel, when, with a slight further separation of the parametrium, the convoluted vessels near the point of junction of the uterine and ovarian arteries are seen hugging the anterolateral side of the uterus. By catgut, likewise carried by a curved needle, these vessels are tied at one or more points and are divided below the ligatures close to the uterus upon each side. As these vessels are divided the anterior peritoneal fold may be penetrated, thus opening the anterior cul-de-sac. If not, the ligation and separation of the parametrial tissues is continued at each side of the uterus, until the anterior cul-de-sac is entered. Unless the body of the uterus is fixed in the pelvis by its large size or by very dense adhesions, it now may largely be withdrawn through the vagina, and, with the trowel holding up the anterior vaginal margin, the fold of peritoneum anterior to the uterus is divided from side to side. By hugging the uterine body and by properly retracting with the trowel, the bladder and ureters are not exposed or injured. The trowel is now introduced into the pelvis anterior to the uterus, the bladder is elevated, and the uterine fundus is grasped with volsellum forceps, brought through the anterior peritoneal opening while the cervix is being released and pushed back into the hollow of the sacrum. Each tube and ovary is now brought into view for final inspection and disposition, and the removal of the uterus is completed with appropriate ligations and division of the round and infundibulopelvic ligaments. Or, if the uterus is large and the exposure of the appendages difficult, hæmostatic forceps are successively applied near the cornu, as the round ligaments, tubes, and ovarian ligaments are divided, and the uterus is cut free, first upon one side and then upon the other. With the uterus out of the way, the tubes and ovaries are inspected and are dealt with in either conservative or radical fashion, as may be indicated, ligatures of catgut being used. It simplifies the operation if both tubes and ovaries are not removed. Usually we remove the tubes, but conserve either both ovaries or at least a part of one ovary. If the patient has passed the menopause, of course, then it is unnecessary to save ovarian tissue. For large uteri and tumors, morcellation is often necessary. If morcellation is required, the vaginal section and the individual ligation and division of vessels lateral to the uterus as high as possible are first completed. The posterior cul-de-sac is opened, but no special attempt is made to open the an-

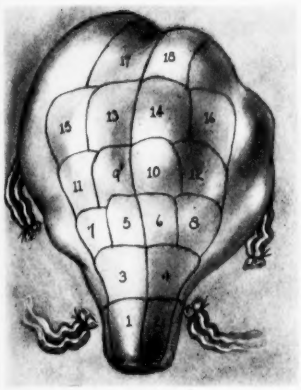

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 10. If the uterus is too large or too fixed for delivery, after ligation and division of the lower lateral blood vessels, it is removed by bisection or morcellation in the conventional way.

Fig. 11. After inspection of the pelvis, the peritoneal and vaginal margins are united over the vascular pedicle by a continuous suture of fine catgut. The peritoneal cavity is not closed. If there is a tendency to procidentia the broad ligaments are united in the midline.

Fig. 12. A Mikulicz drain of iodoform or plain gauze is so introduced into the lower pelvic cavity as to make pressure on the pedicles. Properly introduced, and pushed well up into the vagina, this will not prevent an immediate repair of the perineum.

terior cul-de-sac. While the anterior vaginal margins and overlying bladder are well retracted, the uterus is pulled down and back toward the coccyx, the anterior wall of the cervix and lower part of the uterus is split in the midline, and lateral sections are successively removed. The margins of the resected uterus being repeatedly grasped and everted with traction, new areas are brought into the vaginal field for resection, as the morcellation proceeds in the conventional way. To avoid hæmorrhage, the lateral margins of the uterus are not invaded. As the fundus is approached, the anterior peritoneal fold appears and is divided without difficulty, and finally the remains of the fundus can be delivered through the vagina and the hysterectomy completed. By keeping close to the uterus, adhesions to the intestines or other parts may be seen and accurately divided, if necessary with the ligation or suture of bleeding points. Fibroid tumors as exposed are grasped, avulsed, rocked, and rotated from their capsules, or are split and delivered in sections. It may be necessary to morcellate large pedunculated fibroid tumors in order to deliver them. Ovarian tumors, especially dermoids, may be removed with greater facility after the uterus is out of the way.

Finally with a patient in a high Trendelenburg position, clots and liquid blood are sponged from the pelvic cavity, which is carefully inspected for bleeding or residual disease. If the patient is well relaxed, as is usual under spinal anæsthesia, the intestines gravitate from the pelvis, which can then be thoroughly examined. Not infrequently the appendix is seen and may be drawn by sponge forceps down to the vaginal opening, examined, and, if necessary, removed. For a vaginal appendectomy, the meso-appendix is clamped and divided, the base of the appendix is doubly ligated, divided below the ligatures by a small cautery, and the cords of one of the ligatures used to tie the meso-appendix over the stump. A small electric light on the side of a narrow, long bladed trowel and the use of a special long posterior vaginal retractor are of great aid. In no case of attempted vaginal hysterectomy have we encountered difficulties too great to be overcome from below although in a number the tumors have extended somewhat above the level of the umbilicus.

The operation is completed by uniting the peritoneal and vaginal margins around the entire circular incision by a continuous suture of fine catgut. This suture catches the ligated pedicles, which are carefully pulled down to the lateral vaginal margins and largely covered by peritoneum as an important protection against secondary hæmorrhage, or an infection from an infected pedicle slipping back into the pelvis. If there is prolapsus, support for the vaginal walls is obtained by uniting and perhaps overlapping the round, broad and uterosacral ligaments, a perineorrhaphy and, occasionally, an anterior col-

porrhaphy being done. Drainage of the pelvic cavity is used in all cases. The center of a 30-centimeter square of iodoform gauze is carried through the vaginal opening into the pelvis on a narrow trowel and, with the aid of two right angled narrow retractors or trowels, a snug packing with one long, or a number of short strips of gauze is laid against the pedicles. This packing should be inserted and pushed well up into the vagina before a perineorrhaphy is attempted. A "mushroom" catheter is finally introduced into the bladder to remain for 2 days, the dressings are dusted with sterile boric acid powder, and a pad held by a T bandage applied.

POSTOPERATIVE TREATMENT

The bladder is irrigated with boric acid solution at the end of 48 hours, 8 cubic centimeters of a 20 per cent mild silver protein are instilled, and the catheter is withdrawn. The central strip of packing is withdrawn on the fifth day and the external bag of the iodoform packing on the sixth day, provided it is not unduly adherent. No packing is reinserted. Rarely is it necessary later to push the finger through the vaginal vault to relieve a secondary purulent accumulation as often collects when the vaginal vault is closed by suture. If there has been no perineal repair the patient is permitted to be out of bed on the eighth day and to go home on the tenth day. A week or two later, the vault is inspected and if excessive granulations are found, which is more likely if the tubes have not been removed, these are destroyed in the office, by a fine pointed electric cautery. These granulations usually cause a postoperative leucorrhœa.

ADVANTAGES

The operation has the following advantages:

1. Clamps are not used. The sloughing, the odorous discharge, the tendency to hæmorrhage, which follow the use of clamps, are largely obviated. We have had no postoperative hæmorrhage from this operation. Clamps take up room, and if the uterus is large and vascular requiring morcellation, they may be difficult to apply until there has been an excessive loss of blood. Unless carefully applied and isolated by gauze, clamps may cause serious pressure lesions of the vaginal wall, ureters, bladder, or intestines. By tying the uterine artery and the large descending branch of the ovarian artery before invading uterine tissue, it is usually possible to do an extensive morcellation of a large and vascular uterus without dangerous loss of blood.

2. Individual ligations applied under direct vision are used. The mass ligation of the broad ligaments, unless very carefully made, is dangerous from the tendency of the arteries to retract from within the pedicle and to bleed.

3. The lateral uterine attachments are separated at the first part of the operation, thus giving an early mobilization of the organ. Thus we have found it possible to remove soft, fibrocystic, and vascular uteri which have been classed as contra-indicating vaginal removal.

4. No special attempt is made, as is customary, to separate the bladder or to locate the peritoneum in the anterior or posterior cul-de-sac. As the uterus is progressively liberated from its lateral supports, it descends, and the peritoneal folds readily come into view without being sought. The anterior cul-de-sac is entered rather late in the operation. Thus there is little danger of injuring the bladder or ureters. Only in a case in which the cervix had previously been amputated and a recurrent carcinoma was present, have I opened the bladder while attempting to follow this technique. I have seen no case of ureteral injury, and, indeed, this seems an unlikely accident if the retracting trowel is carefully used, and the ligations made close to the side of the uterus as directed. The trowel lifts the ureter from the side of the uterus.

5. The removal of a large fibroid uterus through a small vagina is often a tedious operation with much morcellation, yet usually it is very well borne by the patient. An important underlying principle is not to attempt to expose at one time a larger field than is required for the particular step of the operation. It may be that the area in view at one time is no larger than a half dollar, yet this is sufficient accurately to separate tissue or to introduce a ligature. Vaginal hysterectomy need not be a blind operation. Every step should be under control of the eye, but the surgeon must be content often to see but little at one time.

6. With a virginal, nulliparous or atrophic vagina, a division of the vaginal wall is at times necessary. A shallow median posterior incision of the episiotomy type, to divide the lower half of the vagina and to extend occasionally a short distance into the perineum usually suffices. We have found no necessity for using the extensive lateral incision of Schuchardt, which is carried to one side of the anus back to the coccyx except for malignant disease.

7. Owing to the slight tendency to peritoneal infection or shock, a vaginal hysterectomy has a lower mortality than a supravaginal hysterectomy, and a distinctly lower mortality than a complete abdominal hysterectomy. In the treatment of hæmorrhagic conditions of the uterus in

middle aged women, it gives a mortality about as low as that of radium, without the sequelæ and relapses of the latter and with greater assurance of disclosing and eliminating a possible malignant condition.

A fibroid tumor at least up to the size of a 7 months gestation may be removed through the vagina. The approach avoids the secondary complications, such as hernia and parietal adhesions peculiar to abdominal incisions.

8. Associated with the hysterectomy, it is possible to do a radical or conservative operation on the appendages and occasionally to remove a diseased appendix through the vagina, as well as to do an associated vaginoplastic operation.

9. Vaginal hysterectomy is the operation of choice, if hysterectomy is required in the presence of hæmorrhage or infection. Hæmorrhage during operation is better borne by the patient subjected to vaginal than to abdominal hysterectomy.

10. Symptoms from postoperative adhesions may rarely occur after vaginal hysterectomy, but probably less frequently than after abdominal hysterectomy.

11. Although easily borne by the patient, vaginal hysterectomy may be much more trying to the surgeon than an abdominal hysterectomy for the same condition. Who, however, would weigh the comfort of the operator against the safety of the patient?

FROM THE CLINIC OF THE WOMAN'S HOSPITAL, NEW YORK

THE TECHNIQUE OF FORMATION OF AN ARTIFICIAL VAGINA

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FOR the past decade, cases of congenital absence of the vagina have received a good deal of attention from gynecologists. Various surgical methods have been proposed for the relief of this condition by the formation of an artificial vagina. These surgical methods can be classified into three different groups.

In the first group are the methods of Kustner, Mackenrodt, and Graves, in which the operation is designed to create a space between the rectum and the bladder, the walls of the cavity being lined with tissues obtained from the vulva and labia. The function of such a cavity would be that of a receptive organ—a vagina. Thiersch skin grafts have also been tried, but none of these methods has met with great success. Neither did the Fraenkel method of immediate flap transplant give better results, because, in this as in the other methods, surgical provision was not made to create a tube which would serve as a receptive organ, and no surgical procedure to form an artificial vagina can succeed unless a definite receptive organ is created. In the methods in the first group, the space obtained by cleavage of the bladder and rectum becomes obliterated in spite of the fact that the denuded walls of the cavity have been lined with tissue from the vulva and labia.

In the second group is the method of Baldwin. He uses a loop of small intestine which he places between the bladder and the rectum to form the vaginal canal. This operation necessitates a laparotomy and resection of the intestine, and it is a question whether this is ever justifiable. The operation has been successful in some cases but it carries a 20 per cent mortality. Furthermore, in many instances patients who have been successfully operated upon by the Baldwin technique, complain of a disagreeable mucous discharge.

In the third group is the operation proposed and practiced by Frank and Geist. In this operation a definite vaginal canal is created from the skin of the inner aspect of the thigh of the patient. It is a modification of this operation that I wish to discuss.

The object of my technique is to obtain a skin flap from the patient's thigh from which to create a vaginal canal. A skin flap from this area will be very pliable, easily handled, and not subject to contraction. With the technique to be described the skin flap undergoes a certain degree of physiologic contraction, and it will have good circulation so that it will not be in danger of sloughing.

The operation has to be done in several stages. The first step consists in preparing a skin flap. An

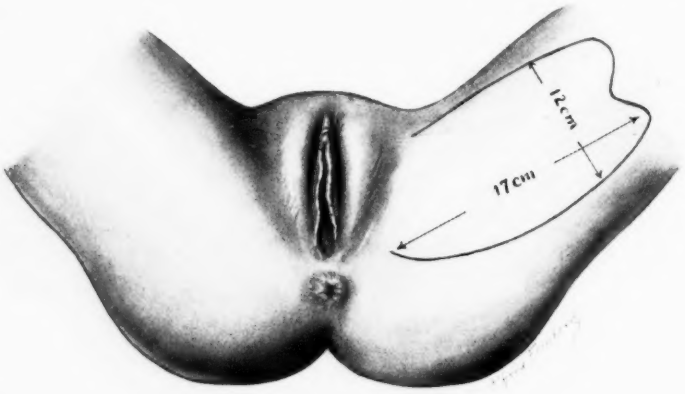

Fig. 1.

Fig. 2.

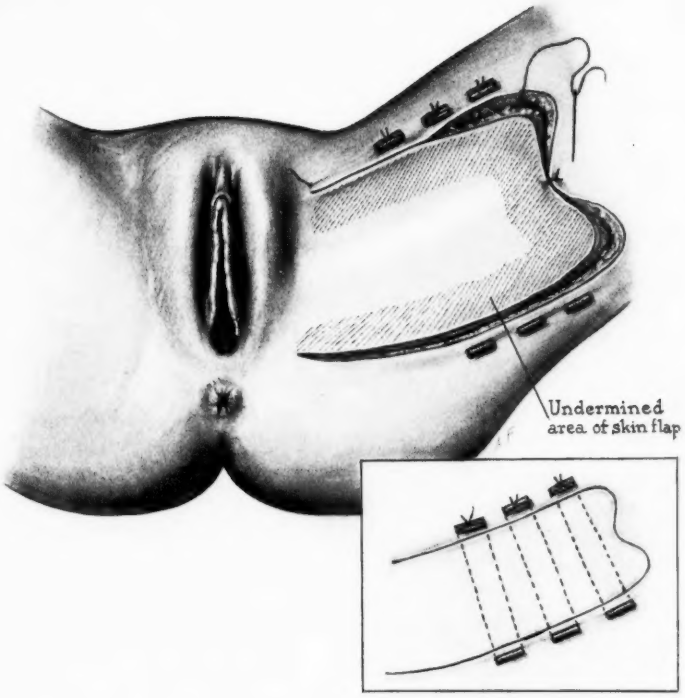

Fig. 3.

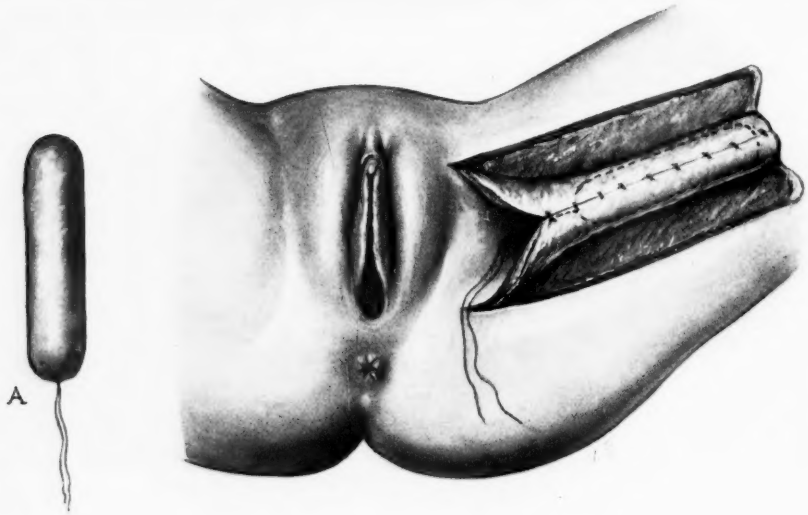

Fig. 4.

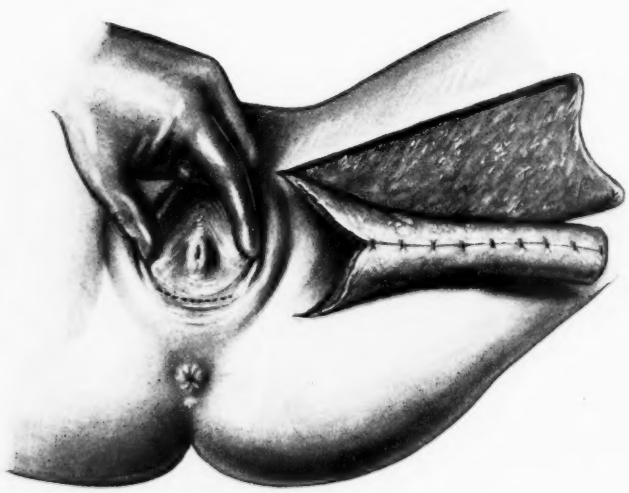

Fig. 5.

outline of the flap is made on the inner aspect of the thigh below the pubic hair line. The skin flap should be 17 centimeters long and 12 centimeters across, and should be curved at the ends, as shown in Figure 2. The incision is carried to the full depth of the skin so as to sever the blood supply. The skin flap is then undermined to the extent of about 1 inch to break up the arterial circulation in that part of the flap, as shown in Figure 3. After it is undermined, the skin is sutured back to its original position by means of a subcuticular stitch of silk or silkworm gut. When all soreness

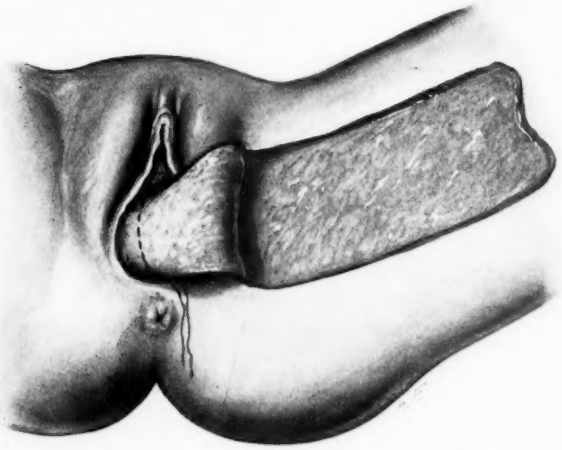

Fig. 6.

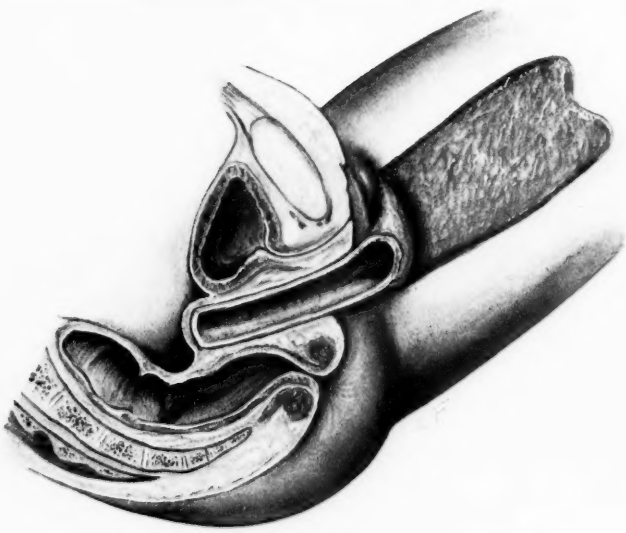

Fig. 7.

has disappeared from the line of incision in the skin, the flap is ready for the second step of the operation.

In the second step in the preparation of the skin flap, the previous incision in the skin is reopened and the skin flap is undermined throughout its full length and breadth, except at its base near the vulva. The object of the undermining is to sever all the blood supply from the flap except at the base and thus to compel the skin flap to obtain its nutrition entirely from this point. After the skin flap is loosened and all bleeding points are tied, the flap is sutured back to its original position with a subcuticular stitch. A few tension stitches

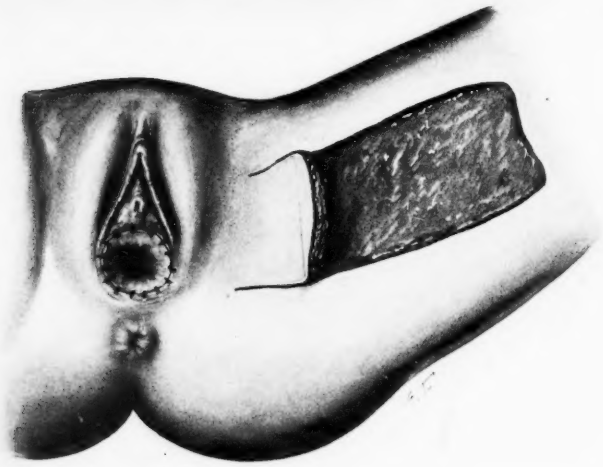

Fig. 8.

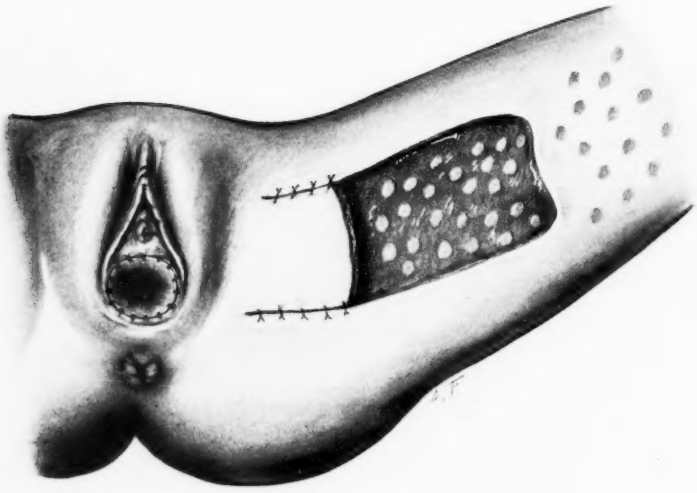

Fig. 9.

may be taken in the skin, as shown in Figure 3, in order to favor the skin flap in contracting on itself as much as possible. A dressing is applied and the skin flap is allowed to heal back to its original position. Nothing further is done with the flap until the soreness from the incision has completely disappeared and the tissue looks normal again.

The next step of the operation consists in loosening the skin flap already prepared from all its surroundings, except its base, whence it receives its nutrition. A vaginal tube is constructed from the skin flap with the skin surface inside the tube and the raw area outside, as shown in Figure 4, and is later tucked into the pelvis between the bladder and the rectum and allowed to remain in this position until it has become firmly adherent to the surrounding parts and capable of obtaining its nutrition from its new surroundings.

Having prepared the vaginal tube, an incision is made in the vulva, as shown in Figure 5. The bladder and rectum are separated from each other. The separation of the bladder and rectum must be so complete as to create a large space and it should be possible to palpate the sacral bone. Into this space in the pelvis, the free end of the vaginal tube, with a rubber tampon inside, is tucked, so that it rests between the bladder and rectum. The newly incised wound in the vulva is sutured around the vaginal tube, as shown in Figure 6. A self-retaining catheter is placed in the bladder and a dressing is applied on the vulva and labia.

Five or six days later a series of incisions are made in the base of the skin flap so as to sever the vaginal tube from it. These incisions are made at intervals, 3 days apart, until the vaginal tube is completely severed from its base. It will take about 6 weeks to accomplish this. In the meantime, the catheter in the bladder remains in position, with daily cleansing. When the base of the flap has been severed from the vaginal tube, it is placed in its original position on the thigh, as shown in Figure 7. The rest of the granulating surface on the thigh is covered with Thiersch grafts, as shown in Figure 8. The grafts take readily and within another week the patient will be able to leave her bed. It will be noticed at this step that there is a tendency on the part of the vaginal tube to contract at its outlet. All efforts are now directed to keep the rim of the tissue at the orifice of the vagina from contracting by continued and repeated dilatations. This is accomplished by keeping in position a vaginal plug of large size. The patient is instructed to wear this vaginal plug at night and as much of the day time as she can afford to give up for this purpose. Effort to dilate the orifice of the vagina must be persisted in for several months, but after the parts are fully healed no further contraction will take place, and a permanent vaginal canal will have been established.

Fig. 10.

REPORT OF CASE

Mrs. K. G., aged 22 years, was admitted to the Woman's Hospital February 5, 1929. She was a native born American and had been married 5 months. Her chief complaint was absence of menstruation and dyspareunia. She had been living with her husband for 5 months and had never been able to have intercourse. She weighed 110 pounds and was 5 feet 3 inches tall. She had a systolic pressure of 135 and a diastolic of 85. Examination of her heart and lungs was negative. The abdomen showed no abnormality. Examination of vulva and external genitalia showed normal labia majora and minora. Her clitoris was normal. The introitus was closed and the urethra was dilated. The perineum looked normal. A rectal examination showed the absence of uterus, tubes, and ovaries. Diagnosis of congenital absence of vagina was made. Examination of the urine showed it to be normal. Blood examination showed 3,800,000 red cells, 86 per cent hæmoglobin and white cells 7,200, polymorphonuclears 74 per cent, Wassermann negative. A bladder sound through the urethra and with the finger in the rectum showed very little tissue between the sound and the finger. Rectal examination with two fingers in the rectum failed to show the presence of the uterus or adnexa. On February 14, 40 cubic centimeters of blood were drawn for sex hormone test. The result was mild positive reaction, showing presence of sex hormone, ovarian tissue probably present.

An operation for the creation of an artificial vagina (first stage) was done February 19, 1929. A pattern of rubber tissue was laid on the thigh to outline the skin incision, the skin was incised, the bleeding points were picked up and tied, the flap was undermined, and the skin was sutured back to its original position with a subcuticular stitch. A dressing was applied.

Three weeks later the line of incision was reopened, the flap was undermined for about one-half of its length and was sutured back to its original position.

Six weeks later the flap was freed entirely from the underlying tissue except at its base so that it must necessarily receive its nutrition only from its base. The flap was very pliable and was once more sutured back to its original position.

One month later the skin flap was again freed from its attachments, and with good circulation in the flap, its edges were sutured together with continuous chromic catgut sutures to form a tube about 4 inches in length and 2 inches in diameter. The tube thus formed was to be placed in the space between the rectum and the bladder. An incision was made in the vulva and by blunt dissection the rectum and the bladder were freed from each other and a space was formed about 4 inches in length and 3 inches in diameter. The walls of the rectum and the bladder presented a freely bleeding surface. The vaginal tube formed from the skin flap, distended with a gauze bolster covered with rubber, was pushed into the hollow space between the rectum and

bladder. The incision in the vulva was sutured to the outside of the vaginal tube which held it in place. A self-retaining catheter was placed in the bladder, and the operative field was dressed with rubber tissue held in place with bandage.

Six weeks later the base of the skin flap to which the vaginal tube was attached was completely severed, thus leaving the vaginal tube between the bladder and the rectum. The vaginal tube measured 3 inches in length and would admit one finger comfortably. A vaginal plug was inserted to keep it from contracting. The base of the skin flap was sutured back on the thigh and the rest of the granulating area on the thigh was covered with Thiersch grafts.

The patient was discharged June 24, when the following note was made: Physical condition of patient is satisfactory. An artificial vagina was created with normal circulation in the tube. Skin grafts on the thigh have thrived normally. The vaginal tube is 3 inches in length and 1.5 inches in breadth. There is some contraction of rim of tube which will need stretching.

December 8, 1929, under light gas anæsthesia in the treatment room, the vaginal rim was dilated with graded vaginal plugs. Two short incisions were made with scalpel in the scar constriction ring. Glass plug No. 8 was then readily controlled by pressure.

March 15, 1931. Patient was examined today and it was found that she has a functioning vagina 3.5 inches deep and 1.5 inches in diameter. The inside of the vaginal tube is smooth and pliable. There are no constrictions at the orifice and the vaginal tube has been functioning perfectly satisfactorily sexually for a year and 2 months.

NEW METHOD FOR TREATING FRACTURES, UTILIZING THE WELL LEG FOR COUNTERTRACTION[1]

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THIS method to be described was devised to treat injuries of the pelvis, femur, and tibia. It depends upon skeletal traction of the injured leg and at the same time employs the well leg for countertraction. Even in the face of the modernization of treating fractures resulting from the World War, this new method presents many distinct advantages: It meets the call for economy, not only to patient but to doctor as well. It conserves time through simplification of reduction. The after care is practically negligible because of absence of weight, rope and pulley, so that much worry is eliminated because of the precision of the mechanism. As to the patient, his physical discomforts are greatly minimized, and hospitalization may be shortened—a fact not to be lightly disregarded in the rising costs of injuries. Therefore, in the hope of stimulating better treatment of fractures, we offer this new and original method.

In order to carry out the principle of well-leg countertraction and injured-leg skeletal traction, a new apparatus (Fig. 1) was devised. It is simple in construction and use, all necessary traction being furnished by turning the nut with the fingers. By means of this splint we have successfully treated dislocation of the symphysis pubis, injuries and fracture of the pelvis and of the neck of femur, intertrochanteric fractures, and fractures of the shaft of the femur and of the tibia.

Skeletal traction, by means of tongs, wire, nail or pin, has been employed in general practice for years, and the use of the sound leg for immobilization in treating injuries of the lower extremity has been employed for centuries. Ancient history records the army mode of handling broken legs by pulling the injured leg to its normal length and bandaging it to the opposite or well leg in the attempt to keep reduction and immobilization. Modern surgeons have been using the spica cast in treating fractures of the neck of the femur, dislocation of the hip, and pelvic injuries, while such men as Michael Hoke, A. Steindler, C. K. Coonse, and Carl P. Jones have used the sound leg for both immobilization and countertraction.

Although time has not permitted a complete survey of the literature, we have found nothing that contradicts our claim to originality. In addition, all appliances, the use of which has produced results which justify their survival, are listed by contemporary authorities, and again nothing has been found which would conflict with my method. Therefore, we believe that we are correct in claiming originality for this method of successfully combining skeletal traction of the injured leg with countertraction of the well leg, and for this adjustable splint, by means of which skeletal traction is connected with countertraction.

GENERAL PRINCIPLES OF FRACTURE TREATMENT

Consensus of opinion regarding principles of ideal fracture treatment demands complete reduction as soon as possible following trauma and immobilization so secure that the best function obtains in the shortest time.

Let us evaluate these ideals. Our method provides: (1) the immediate reduction of the fracture in the hospital, at home, or in the X-ray room; (2) an easy but accurate reduction without shock-producing manipulation; (3) the maintenance of perfect immobilization; (4) the accessibility of all of the injured area to physiotherapy; (5) the securing of the best of functional results; (6) the consequent better attitude of the patient through this anatomicophysiological fact. That our method fulfills all these ideals will be seen by examination of cases reported here.

Hip fractures. This new method of treatment as applied to hip fractures has been proved sound not only by results but by adherence to the generally accepted principles of treatment, as advocated by Whitman: abduction, hyperextension, and internal rotation. Although the theories agree, our practices are decidedly different, for in our method traction pulls the legs down in a nearly parallel position, while in Whitman's method traction is exerted while the legs are widely separated. It may seem paradoxical to expect abduction with the legs so close together, but radiographic evidence proves that abduction does occur (Fig. 2, B). During the movement of reduction, the traction force pulls the acetabulum down on the injured side, while countertraction forces the well acetabulum up, thereby changing the angle of the transpelvic line with the axis of the injured leg, from an acute to an obtuse angle. This in turn forces the angle of the neck with the shaft of the injured femur into the normal position of 135 degrees. (In Figure 2, note transpelvic line *bdc* and long axis of leg, *f*, also angle of neck with shaft of femur before and after reduction.)

[1]Presented before the Seattle Surgical Society, September 25, 1931, and the King County Medical Society, Seattle, Washington, October 19, 1931.

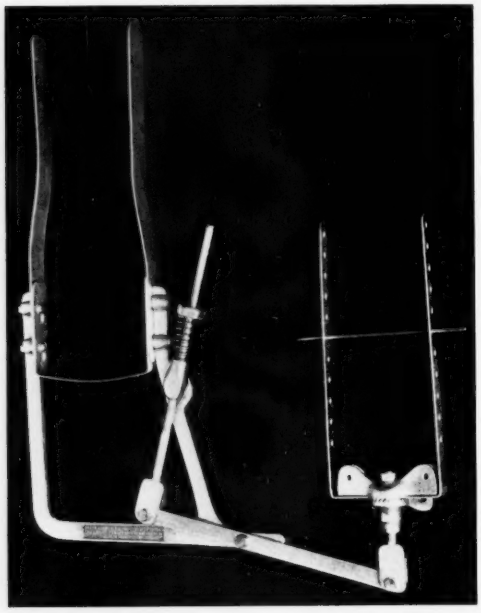


Fig. 1. Original splint combining skeletal traction of injured leg with well-leg countertraction.

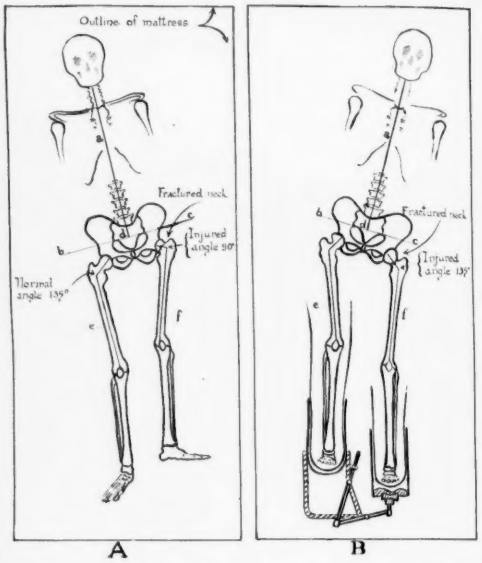


Fig 2. A, Position of patient in bed with fracture of the neck of left femur, before reduction. Notice the usual external rotation and shortening of the injured left femur, with the axis of the neck to the shaft at an angle of only 90 degrees; the acetabulum of the injured side is displaced upwards. B, After reduction, position of patient in bed with splint. Note restoration of normal angle of the neck upon the shaft. The acetabulum of the injured side is now displaced downward. Also note absence of any pelvic tilt.

Skeletal traction transmits tension to the hip joint capsule, its ligaments, and adjacent muscles, thereby accomplishing apposition and immobilization. Thus the fragments are held in fixed position between a taut, muscular, and ligamentous envelope—an internal splint, as it were.

As traction displaces the acetabulum downward on the injured side, the patient prefers to lie on the bed with the upper part of the body toward the injured side, a position he should be encouraged to assume. From a cursory glance the pelvis may appear tilted, but closer examination clearly shows no abnormal relationship between spine and pelvis and, consequently, no danger of list or scoliosis, because the spine sets at right angles on the pelvis (Fig. 2, B, angle *bda*). Abduction, therefore, is obtained in a physiological manner at the hip and not by a pathological list to the pelvis.

CONSTRUCTION OF APPARATUS

The simple device (Fig. 9) used in our treatment is made chiefly of aluminum castings, weighing only 2 pounds. The countertraction portion consists of a frame, *7*, to which is attached a thin, flexible countertraction stirrup, *1*, with removable base, *2*, to be later molded to the cast of the well leg. A tranverse lever, *15*, which connects this countertraction side to the traction part, is pivoted to this frame, the axis of which is about 6 inches distal to the sole of the well foot. On a threaded traction rod, *10*, which is joined to this end of the lever, is a nut, *14*, to furnish traction force, and a coiled spring, *13*, to ensure smooth, flexible, yet ever constant, traction.

The traction portion of the splint is made up of another stirrup, *24*, with perforated sides for the insertion of the pin, and is connected to the lever arm by the traction rod, *20*, through the center of which at its proximal end is the rotation adjustment, *22*, with its lock-nut, *21*, for internal or external rotability.

APPLICATION OF THE APPARATUS

The technique of applying the apparatus is simple (Fig. 3). First, a well padded plaster-of-Paris cast is applied to the well leg which is held in marked adduction, the cast being made to extend from 1 inch beyond the toe nails to the midthigh. In about 5 minutes, the cast is sufficiently set to permit the molding in of the coun-

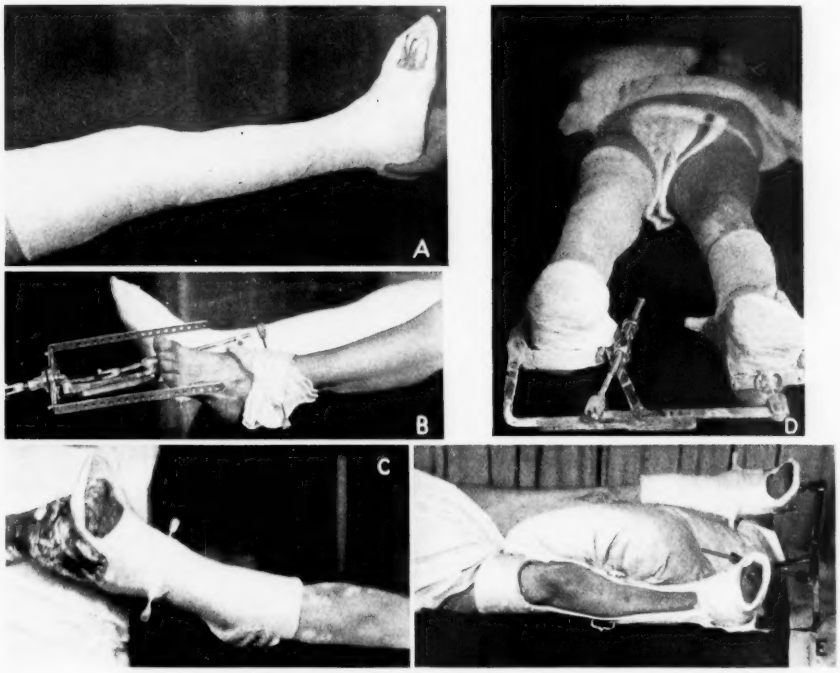


Fig. 3. Steps in application of splint and reduction of fracture. A, Cast applied to well leg. B, Pin inserted through distal end of tibia of injured leg. C, Pin incorporated in short cast, the ends of the pin having been covered with corks, to be enclosed in cast. D, Splint firmly anchored and traction applied. E, Part of the anterior portion of cast removed. Lately we have been leaving a transverse band of plaster in the region below the knee, as noted on cut. See case report No. 4.

tertraction stirrup, which is secured by a few turns of plaster bandage. This stirrup is so constructed and should be so applied, that there will be sufficient room between it and the ankle to permit the later exposure of the malleoli.

Next, we prepare the lower end of the tibia above the malleoli for the insertion of the pin, by first cleansing with ether, iodine, and alcohol. Then, this area and that between the fractured ends should be anæsthetized with 2 per cent novocain, according to the method popularized by Boehler. As a rule, our patients are previously given a hypodermic of one-fourth grain morphine sulphate.

A solid Steinmann pin is hand-drilled just two fingers' breadth superiorly to the tip of the *internal* malleolus. A few flat dressings are spiked over the pin ends, then temporarily corked, and one dressing is twisted around each end.

A light cast is now applied over sheet wadding from 1 inch beyond the toe nails to about 4 inches below the knee joint. In a few minutes this plaster is sufficiently set, so that the stirrup can be brought down and the pin slipped through those perforations which permit the closest approximation of the traction rod to the cast on the sole of this foot. This stirrup and the corks, which are put over the pin ends, are then incorporated in the cast with plaster bandage.

Traction can now be commenced by turning down the nut on the countertraction rod, which is so constructed and threaded that over 40 pounds pressure can be obtained by the fingers alone. Therefore, care must be exercised not to give too much traction. When the lever arm is about parallel to the distal edge of the frame, the necessary amount of traction will usually have been exerted.

For either external or internal rotation the adjustment device is loosened; when the leg has been rotated to its normal position, it is again secured by screwing down the lock-nut. After apparent length and alignment are reached, a roentgenogram is taken, and adjustments made as indicated.

Fig. 4. Fracture of left pubic and ischium reduced and immobilized with splint. See report of Case 1.

A B

Fig. 5. A, Before reduction, fracture of neck of right femur. B, After reduction, restoration of normal angle between neck and shaft. Case 2.

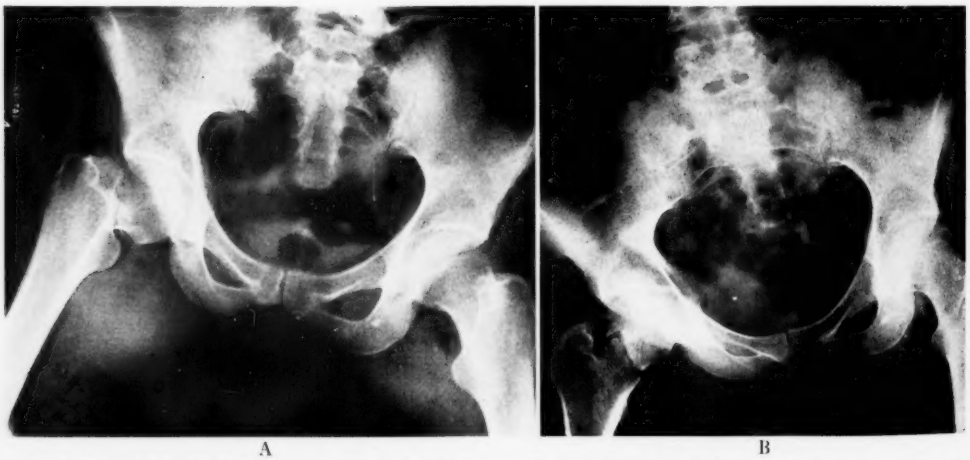
To avoid pressure on the common peroneal nerve, the cast is cut out over the posterolateral aspect of the head of the fibula of the well leg. If the patient complains of pain in the heels, the cast may be split or cut out in this area. If desired most of the anterior half of the cast of well leg and also that of the injured leg may be removed, leaving only a few encircling bands.

The patient need not be removed from the same cart that he entered the hospital on, for either roentgenograms or reduction itself. As there is no need for traction table, reduction may be carried out in the home or in the hospital bed, but in no case until a preliminary X-ray examination has been made.

Meanwhile the patient's bed has been prepared with a fracture board and a trapeze and, if available, a Bradford frame. The head of the bed is elevated and the back-rest may be of immediate use (Fig. 7). Free play of the trapeze enhances his general physical well-being, with a resulting increase in circulation, appetite, and mental euphoria. In no way do these benefits—elevation of bed, back-rest or trapeze—interfere with reduction.

TERM OF IMMOBILIZATION

Progress of the case is checked by frequent roentgenograms, which act as a guide to treat-



A B

Fig. 6. A, Before reduction, fracture of neck of right femur. The acetabulum of the injured side is displaced upward. B, After reduction, the acetabulum is displaced downward. Note that the axis of the spine sits at right angles to the transpelvic line. Case 3.

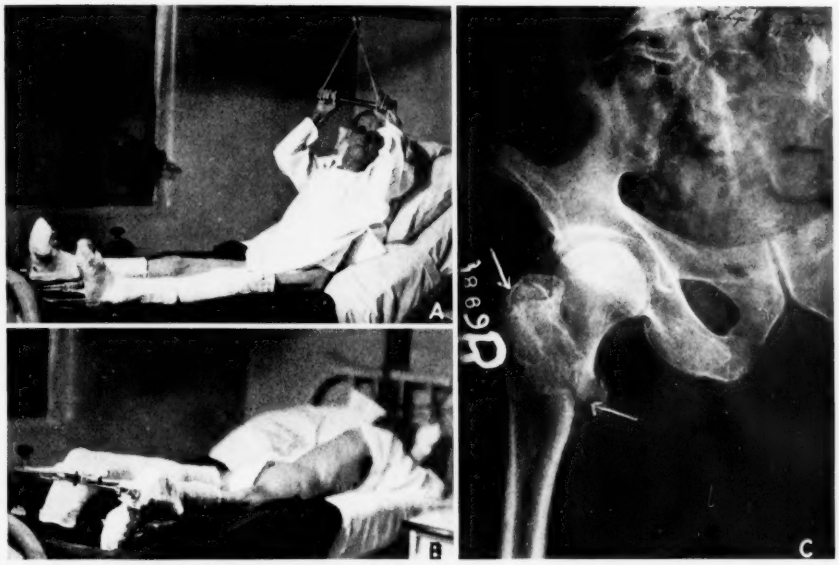


Fig. 7. A, Intertrochanteric fracture of right femur. Patient sat up most of the time. B, Patient was incontinent, so he was turned over daily. C, Later X-rays show perfect reduction in spite of moving. Case 5.

ment, the period of immobilization, and the ultimate removal of the cast. Again, let us caution against overtraction, often the cause of non-union in fractures.

Functional prognosis depends upon many factors; even youth and perfect physical condition do not work to the best advantage without benefits of physiotherapy, which can easily and safely be given by our method, because the injured area is already accessible and all joints can be made accessible by removing anterior portions of the cast.

The period of immobilization is variable. We have found it better to overimmobilize because complications which usually arise from lengthy immobilizing—stiffness of joints and atrophy of muscles—are minimized by our method. For

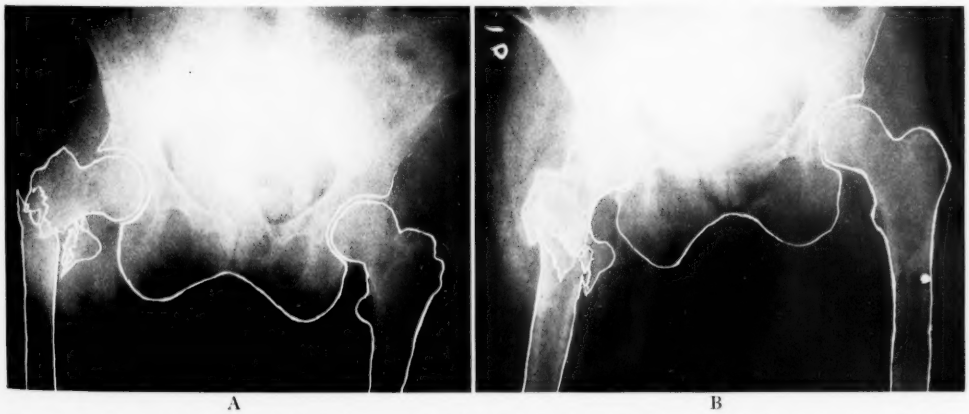


Fig. 8. A, Comminuted intertrochanteric and subtrochanteric fracture of right femur before reduction. B, After reduction. Case 6.

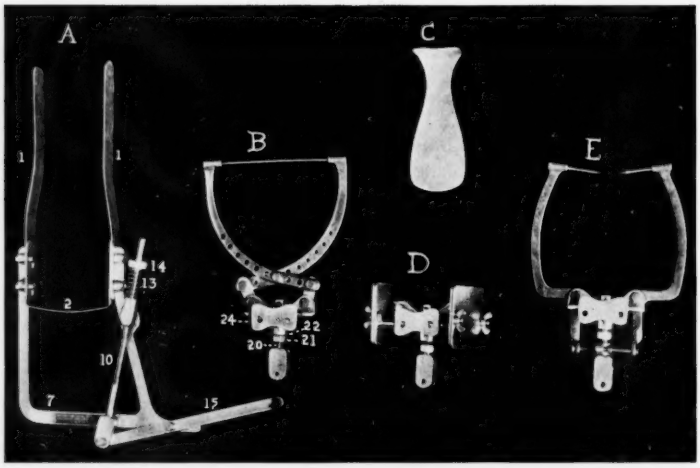


Fig. 9. Well leg countertraction splint, showing modification of attachments for skeletal traction. A, Countertraction portion of splint. B, Attachment for Pierson type of pin-spreader. C, Adjustable foot-rest, to be used without cast on injured leg. D, Modification for use with Buck's extension. E, Attachment for special tongs, stainless steel points.

fractures of the pelvis the period ranges from 4 to 6 weeks; for fractures of the femoral neck, 12 to 14 weeks; intertrochanteric fractures, 7 to 9 weeks; femoral shaft fractures, 5 to 7 weeks; and those of the tibia, 4 to 12 weeks.

REMOVAL OF PIN AND DRESSINGS

The dressings should not be changed from the time of the insertion of the pin until its removal. In some of our cases they have remained for 16 weeks, without even inspection of the wound. A slight, serous discharge, as a result of irritation from the pin not securely incorporated, may occur but the dressing should not be changed, for this promptly clears up when the pin is removed.

To remove the pin, which may be done without pain to the patient, a hole about 3 inches in diameter is cut out around the pin in one side of the cast. When sheet wadding, dressings, and crusts, if any, are removed, the pin is thoroughly cleansed with sterile water, ether, and iodine, and gauze saturated with iodine is left in contact with the pin for a few minutes. The opposite end of the pin protruding through the cast is then grasped with pliers and slowly pulled out, after which a dry gauze is placed against the pin wound and the excess iodine wiped off. The opposite pin wound is not dressed unless it is desirable to remove the whole cast at this time. Generally the pin wounds need no further dressing.

PREFERENTIAL USE OF SOLID PIN

The solid pin is preferred to the divided pin, because the latter does not withstand severe strain and often breaks. Although tongs can be used with this method, our choice remains with the solid pin, since traction is not only supplied more efficiently, but the fragments can also be rotated, elevated anteriorly, or depressed posteriorly. Tongs not infrequently pull out, an accident which does not happen with the pin. From the theoretical standpoint the removal of the pin may cause infection, but we have never had a single incidence.

The incorporated pin. Advantages accrue with the incorporation of the pin in the cast, in that chances of infection are greatly diminished, as internes are then not tempted to dress wounds. These unchanged dressings, previously referred to, have often been left 12 weeks, and have healed promptly on removal of the pin. A pin, securely fastened and covered by the cast, removes all danger of pressure necrosis; and if a patient is not informed of its presence, he is not conscious of it until its removal, for there is absolutely no pain with a well fastened pin (Fig. 3, E).

ALTERATION OF TECHNIQUE

Using the same splint as illustrated in Figure 1, the technique described may be altered to suit the unusual case or when complications demand. The

A B

Fig. 10. A, Fracture of the shaft of left femur with 2-inch shortening, before reduction. B, After reduction, which resulted in overextension; later corrected. Note pin through distal end of femur, incorporated in cast. Case 7.

pin has frequently been inserted through the distal end of the femur above the condyles, occasionally through the crest of the tibia, or through the os calcis or it may be put obliquely through the greater trochanter.

The transverse part of the countertraction stirrup can be removed, permitting the application of the splint to the well thigh with the knee straight or flexed, so that countertraction pressure is against the anterior surface of the superior portion of the tibia.

Special treatment may be demanded in exceptional cases, as in injury, disease, or deformity of the knee, or in double fracture, that is, fracture of the femur with associated fracture of the tibia of the opposite or well leg, or in badly compounded or soft tissue cases. In such instances it may be necessary to apply a pin through the well femur for countertraction, the pin being held by the slots of the countertraction stirrup.

It may seem deleterious to the knee joint and its ligaments to reduce the femoral shaft by the application of skeletal traction at the lower end of the tibia, but we have had no sequelæ from its actual use. In order to obtain internal rotation with a pin so placed, it is only necessary to rotate the tibia a little further inward to take care of the slight loss of rotation at the knee. Successful usage of the past 5 years warrants these statements.

FRACTURES OF THE FEMUR ABOVE THE CONDYLES

Fractures of the femur above the condyles, having long been considered a source of difficulty and worry, can be readily handled with this method. The *modus operandi* of treating these fractures is the subject of a paper now in the course of publication (Fig. 12).

OPERATIVE CASES

In cases of malunion and non-union of fractures of the leg and in hip and other reconstruction operations, the splint described can be more profitably employed than the fracture table. Immobilization without general anæsthetic, is done before the operation—preferably 1 or 2 days before—whereas with the fracture table, it is necessary to apply a spica cast or traction with the patient

A B

Fig. 11. A, Fracture of the shaft of right femur, before reduction. B, After reduction. Cast extends only to level of the lesser trochanter. Case 8.

under continued anæsthetic, following the operation. In patients with non-union, shock is generally present, and to continue the anæsthetic and to keep the patient exposed while applying a spica cast only augments the shock. Moreover, such time spent in a cold, wet cast is an invitation for further complications.

Since our means of traction and immobilization are not attached to the operating table, but are an entity with the body, the patient may be turned on the side or placed in the most accessible position for operation. The danger of reduction or of the graft slipping after the operation, while the patient is being removed to bed, could not occur with a method where means of constant traction and reduction are applied before the operation. Therefore, this inexpensive apparatus is a more than valuable substitute for the expensive fracture table, even in the well equipped hospital.

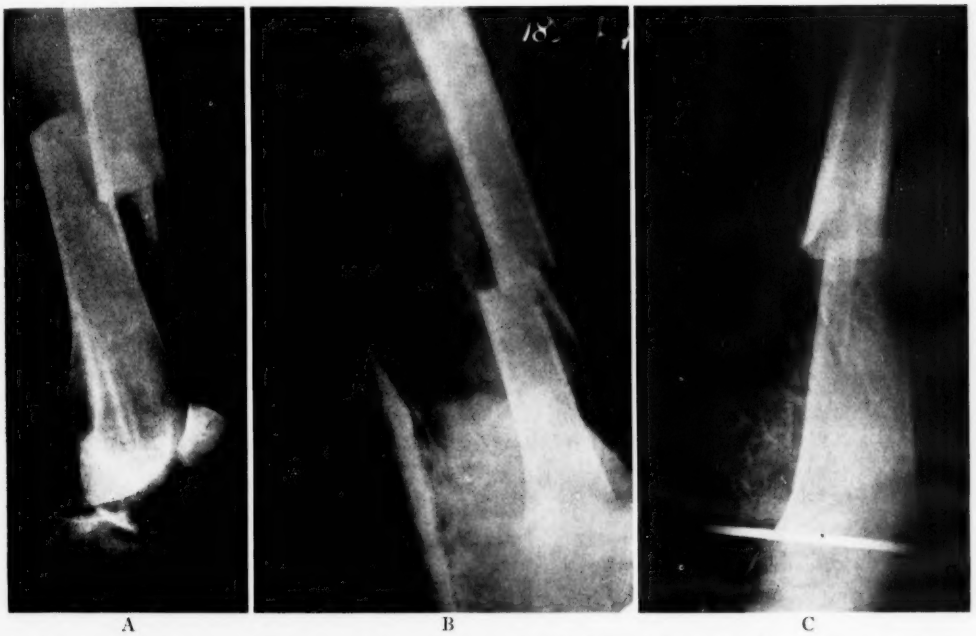
MODIFICATIONS

It must be understood that the apparatus may be used other than previously referred to. Its very form has been altered in many ways to meet personal preferences.

At the suggestion of Dr. Cotton, of Boston, this splint has been so constructed that tongs can be attached (Fig. 9, *E*). Bolts are furnished whereby the Pierson type of spreader can be employed (Fig. 9, *B*). A further adaptation permits the use of a Kirschner wire, and the foregoing adaptations may be incorporated or not in the cast as preferred. Special castings have been made which can be quickly fastened to the splint, thus permitting the use of Buck's extension (Fig. 9, *D*). When pin, wire or tongs are used without a cast on the injured leg, or when Buck's extension is preferred, we have devised an adjustable foot-plate—the foot is strapped therein, preventing toe and foot drop and assisting in rotation of the leg (Fig. 9, *C*).

For those who prefer the Maxwell-Ruth method, an adjustable extension can be attached, thus providing the desired traction and rotation. This extension may also be used to insert and hold pressure pads, as used in treating certain shaft of femur fractures. For advocates of the Russell method, the necessary adaptations can be fitted on.

Our method differs from others in that we depend upon direct skeletal traction while employing the well leg for countertraction.



A B C

Fig. 12. A, Lateral view of compound comminuted fracture of right femur, before reduction. B, Lateral view, after reduction. C, Anteroposterior view, after reduction, pin through distal end of femur. Case 9.

Properties of wide adjustability, without any letting up on traction, not only give greater value for fracture treatment but also for non-union and reconstruction operations.

Our method is successfully employed without the application of any plaster to the injured leg.

Since all of the injured area and that of the joints on the anterior surface are exposed, greater benefits of physiotherapy accrue (Figs. 3 E, 7 A and 14).

There is no pressure against the soft part of the injured leg. Countertraction is exerted only against the sole of the well foot, physiologically suited for pressure, hence no possibility of pressure sores.

This method is more universal in that it treats not only pelvic and hip fractures but also those of the shaft of femur and tibia.

This new apparatus is simpler in design and construction; therefore, is less expensive.

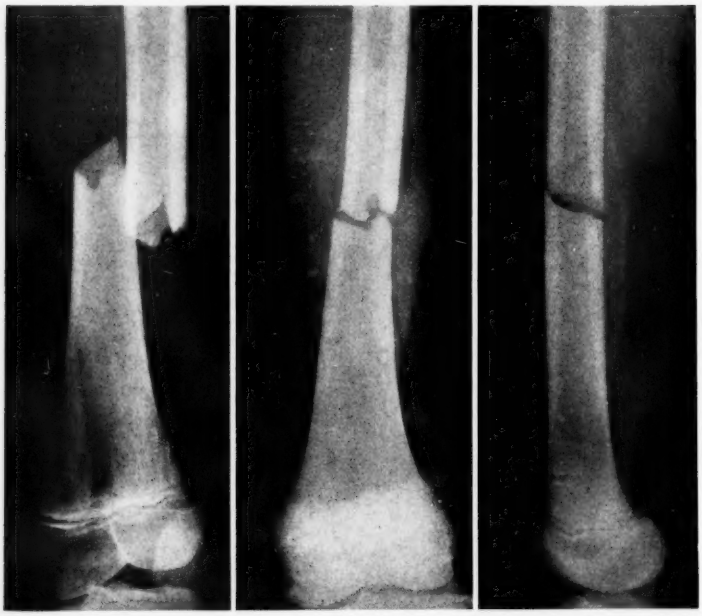
ADVANTAGES TO PATIENT

To appreciate the advantages accruing to the patient, one must view a case from the time of injury through convalescence. Immediate and easy reduction, without general anæsthetic, is of shock-saving importance. As this new apparatus is not primarily a hospital appliance, it allows of home treatment or shortened hospitalization, since the transfer home may be accomplished without endangering either immobilization or traction. In fact, movement becomes a decided factor in convalescence, the removal of the patient to a solarium or outdoors involving no risk to traction, but a gain in physique (Fig. 10, A).

We have long recognized the fact that function depends to a great extent on the correct mental attitude of the patient. Keen to the enjoyments of active and passive movements, obtained by massage, trapeze, and back-rest, the patient feels this functional improvement through increased appetite and general well-being (Fig. 14). In this way, circulatory and pulmonary complications and stiffness of neighboring joints are avoided, a point to be taken cognizance of especially in the treatment of the aged.

ADVANTAGES TO SURGEON

We feel sure that all surgeons have felt the need of a new method, whereby the elaborate equipment of ropes, pulleys and weights, which requires constant supervision, or the cumbersome unphysio-



A B C

Fig. 13. A, Anteroposterior view, fracture of left shaft of femur, before reduction. B, Anteroposterior view, after reduction. C, Lateral view, after reduction. Case 10.

logical spica cast could be eliminated. It is because traction cannot change that our splint requires such occasional care by the doctor. The facts that hospitalization is shortened and that neither anæsthetist nor expensive fracture table is called for, plus the low cost of the apparatus itself, are of economic significance to the doctor as well as patient. The lay journals are commenting on the high cost of illness, and it would seem that one way the medical profession could accept this challenge would be to adopt our method, with simplification of complicated processes which result in less cost per fracture.

Simplification of technique and after-care is the keynote of this new method; reduction is accomplished with surety and ease; the traction table is not needed for operative or non-operative work; and portable X-rays are not necessary, as a patient may be moved to the X-ray room without endangering traction or immobilization.

RÉSUMÉ OF TWELVE CASE HISTORIES

Records of case reports were complete to October 24, 1931, when submitted for publication.

Case 1. E. A. E., male, aged 51 years, weight 168 pounds. Diagnosis: fractured left ischium and left pubic bone (Fig. 4). Patient was caught in a cave-in, September 2, 1931, and was struck on the left side. He also injured both knees and testicles, and had a left sacro-iliac strain and an injury to the ankle. A splint was applied with usual casts, no anæsthetic being used. Marked abdominal distention and distress were noticed, also swelling and excessive ecchymosis of the scrotum and testicles. The cast was later cut out over the ankle of the well leg, due to pain and some swelling. About 3½ weeks after the accident, patient had acute pleurisy, lasting 2 days. The splint was removed at the end of 1 month. There were no pressure sores and the pin wounds healed quickly. He is now walking with the aid of crutches.

Case 2. R. R. K., male, aged 41 years, weight 190 pounds. Diagnosis: fracture center neck of right femur (Fig. 5). Falling from a six-foot step ladder, July 24, 1931, patient broke the right hip and the head of the right radius. Under anæsthetic, a pin was put through the distal end of the right tibia. A cast was applied to the well leg but extended only to below the knee and not to midthigh as is the routine method in most cases. As the patient was a very active male, he was exceedingly restless, moving about a great deal and using the trapeze frequently. Subsequent roentgenograms revealed good position. After the first few days the patient became reconciled to inactivity and was comfortable and happy. There have been no complications. The cast was removed at end of 3 months, and return of movement in knees and hip has been satisfactory.

Case 3. G. M., female, aged 29 years, weight 134 pounds. Diagnosis: fracture center neck of right femur (Fig. 6). August 8, 1931, patient fell on a slippery sidewalk, fracturing femur and both bones of the right forearm above the wrist. Under gas anæsthetic, a solid pin was put through the

lower tibia, with the application of the usual casts. Patient was very restless the first week and nearly tired herself out by continually sitting up. Because of pain around the malleoli, the casts were cut out. A swelling at first of the well thigh later extended over to the injured leg—it was secondary to a pelvic phlebitis. The cast was removed October 25, 1931. When the pin was removed, only one small drop of blood could be seen and pin had not been dressed for nearly 3 months.

Case 4. M. J., female, aged 79 years, weight 190 pounds. Diagnosis: intertrochanteric fracture of left femur (Fig. 3). Patient slipped on floor and injured her left hip September 10, 1931. Under local anæsthetic, a solid pin was put through the lower tibia, with the usual casts. Patient is childish and exhibits other evidences of senility, also has hallucinations and is incontinent. She appears to be in good condition, sits up a great deal, and is turned over on her side daily. She has no complaints. The cast was cut out over the knee and leg.

Case 5. F. M., male, aged 70 years, weight 98 pounds. Diagnosis: intertrochanteric fracture of right femur (Fig. 7). Patient fell and injured his hip, September 10, 1931. Under local anæsthetic, a solid pin was put through the lower tibia, and the usual casts applied. Patient is senile and has arthritis of the hands and feet, with deformities; Dupuytren's contracture of the palms; also opacity of the corneas, with practically a loss of vision. Since patient was involuntary, the nurses had been turning him on his abdomen for some time, before we found this out. Subsequent roentgenograms revealed 100 per cent reduction, so we have continued to have him turned. Patient is still in splint, perfectly content; with no complications.

Case 6. R. S., female, aged 60 years, weight 140 pounds. Diagnosis: comminuted intertrochanteric fracture of right hip (Fig. 8). Patient fell and broke her hip July 15, 1931. Patient was a mental case, had hallucinations, and was so vicious at times that she would bite and scratch and refuse to be turned. She had involuntary movements and a sore started to form on the buttocks; therefore, the cast was later continued to the ribs on the injured side, when she was easily turned over. Splint, cast, and pin were removed at the end of 2 months; she had good union with about ¼ inch shortening. Roentgenograms showed a bony union with some slight medial displacement of the upper end of the distal fragment.

Case 7. J. S., female, aged 11 years, weight 95 pounds. Diagnosis: compound fracture of shaft of left femur (Fig. 10). Patient was seriously injured in an automobile accident, July 21, 1931, receiving a compound fracture of the left femur, besides a skull fracture. Internal injuries were suspected, due to vomiting and abdominal pain and distention. Gas anæsthetic was given in order that the compound femoral wound could be treated at the same time. Pin was put through the distal end of femur and incorporated in a cast which extended 4 inches above the fracture site. At first too much traction was obtained but this was corrected by loosening the traction nut. The cast on the well leg did not extend above the knee and a pressure sore developed later after she left the hospital, the only incidence of such a result recorded. Patient left the hospital on the fourth day and came under care of others, who report that excellent union was obtained, with no shortening.

Case 8. D. M., male, aged 6 years, weight 58 pounds. Diagnosis: fracture of the center of the shaft of the right femur (Fig. 11). Patient was struck by an automobile, October 3, 1931, and came to hospital in a condition of shock. He showed a great deal of abdominal distress; he had superficial excoriations around the thigh, also marked deformity and shortening of the right thigh. Ethyl chloride for a few minutes was used while an undivided pin was inserted through the lower tibia. The cast extended to the midthigh on the well side; to the groin on the injured side. Subsequent roentgenograms revealed good reduction. He was hospitalized only 2 weeks, and is now under the care of his mother.

Fig. 14. Intertrochanteric fracture of right femur. Patient sat up and moved around from the first day, but a firm union was obtained, with perfect end-results. Case 11.

Case 9. D. M., male, aged 46 years, weight 178 pounds. Diagnosis: compound fracture of shaft of femur, about 7 inches above right knee joint (Fig. 12). Patient was struck by an automobile, September 12, 1931. Because of the compound fracture, reduction was done under nitrous oxide gas, and a pin was put through the distal end of the femur. To overcome the pull of the gastrocnemius muscle, reduction was obtained by a slight alteration in application of cast on the injured leg. This will be reported in detail in a subsequent paper. The buttocks were so badly bruised and lacerated at the time of the accident that turning on his abdomen, which the nurses had done without orders, caused him pain, and was stopped. Patient is still in the splint; the compound wound has entirely healed under conservative treatment. The last roentgenograms show no shortening.

Case 10. J. P., male, aged 13 years, weight 105 pounds. Diagnosis: fractured shaft of left femur (Fig. 13). Patient fell off a horse, July 14, 1931. The pin was first put through the distal end of this femur which was incorporated in a cast extending to a little above the midthigh. Later difficulties were encountered, as the pin was defective and broke, so that the cast on the injured leg was removed, another pin inserted through the distal end of the tibia, and a new cast applied up to the groin. The patient was permitted the daily use of a wheel chair and propelled himself around. Excellent end-results were obtained, with no shortening. This boy is now attending school, and he directs no more attention to this leg than before the accident.

Case 11. A. R., female, aged 57 years. Diagnosis: subtrochanteric comminuted fracture of right femur (Fig. 14). The patient, a very large woman, weighing over 200 pounds, fell and broke her right hip, July 22, 1931. She had had infantile paralysis at the age of 2, the right leg remaining short and weak; the foot was in equinus. She had been on crutches until 1922, at which time she was successfully operated on by Dr. E. A. Rich, when the right knee-joint was

A B C

Fig. 15. A, One month old comminuted fracture left tibia and fibula in 300-pound man unsuccessfully reduced by 30 pounds skeletal traction. B, Reduction obtained by well leg countertraction. Lateral view showing the distal and superior pins. C, Anteroposterior view with superior pin incorporated in plaster.

fused. The pin was inserted through the tibia above the ankle. We were unable to get satisfactory roentgenograms with the portable apparatus, on account of the excessive adipose tissue around the hips, and it was necessary to remove her to the X-ray room. There were no complications and she was very happy except that the last few days before the pin was removed, it became loose. When the pin was removed a large amount of discharge was present, due to the irritation of the loose pin, but this promptly healed in a few days after its removal. Patient is now on crutches, and the last roentgenograms reveal excellent union and alignment.

Case 12. G., male, aged 50 years, weight 300 pounds (Fig. 15). In an automobile accident, August 20, 1931, patient suffered a comminuted fracture of the left tibia and fibula. He was first treated in another town, an attempt being made to reduce the fracture and then hold the leg in a cast. This treatment was not successful, so a pin was put through the os calcis and 30 pounds' traction was applied but still without producing reduction. One month after the accident I saw the patient for the first time. The splint was applied and the shortening was overcome. A second pin was put through the upper tibial fragment to overcome the posterior displacement of the distal end of the superior fragment. When reduction was obtained the second pin was also incorporated in the cast and the patient sent home (Fig. 15, C).

SUMMARY

The new method of fracture treatment described depends upon skeletal traction of the injured leg, while it employs the well leg for countertraction.

An original splint has been devised on the application of this principle, thus connecting injured-leg skeletal traction with well-leg countertraction. While extremely simple it has a wide range of adjustability, for abduction or adduction and internal or external rotation may be had at any time, without letting up on traction.

This method has been successfully used for dislocation of the symphysis pubis, for injuries and fractures of the pelvis, neck of femur, intertrochanteric fractures, and fractures of the shaft of the femur and of the tibia.

For hip fractures abduction is obtained by displacement of the injured acetabulum downward due to the pull of skeletal traction, while the well acetabulum is displaced upward due to the push of countertraction, with no tilt to the spine upon the pelvis.

This apparatus is a more than valuable substitute for the fracture traction table in operative work on non-union and reconstruction cases.

The solid pin is empirically safe. Five years, without a single incidence of infection either before or after removal, is proof against any adverse criticism.

Adaptations have been provided in order that the splint may be used with tongs, wire, and pin

spreader, also for Buck's extension, and attachments for the Russell and Maxwell-Ruth methods.

The original method or its modifications have successfully been used, without application of any cast to the injured leg.

The small hospital can now handle these cases as efficiently as the more elaborately equipped hospital, since expensive fracture table, portable X-rays and extensive equipment of ropes, pulleys and weights are nonessential.

This new method benefits the patient in shortening hospitalization, minimizing complications and discomforts, and at the same time assures better anatomical and physiological results.

Benefits to the doctor are economy of time, in application and especially in after-care, through simplification of the process of reduction and surety of immobilization and traction, plus economy of anxiety through assurance of better anatomical and physiological results.

THE SURGERY OF THE UNDESCENDED TESTIS[1]

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From the Department of Surgery, University of Minnesota

THE ideal procedure for the correction of undescended testis is placement of the organ into the scrotum before the degenerative changes which occur with puberty have had occasion to obtain. Unfortunately, however, there is no uniform agreement yet as to the disposition which should be made in most instances of undescended testes. The fear of malignancy in the undescended testis has frequently prompted its excision when otherwise an attempt would have been made to place it in the scrotum. The belief that the spermatic function of the undescended testis is not improved by bringing it into its normal location has also been a deterrent to the routine performance of orchiopexy.

It was once believed that patients with bilateral failure of testicular descent were like castrates. Sir Astley Cooper when consulted by a medical student presenting this anomaly informed the unfortunate inquirer to this effect of his predicament, whereupon the young man went out and committed suicide. Cooper then had occasion to examine the testes and found spermatozoa present in both. It is now well known that the interstitial cells in the testis are responsible for the development of the secondary sex characters in the male. They were first described in 1854, but their function was disputed until 1903, when Bouin and Ancel finding only the interstitial cells normal and the spermatogenic cells absent in cryptorchid pigs suggested that these cells were responsible for the development of secondary sex characters. The Sertoli cell lying on the basement membrane of the seminiferous tubule has not been as satisfactorily ruled out as playing no part, as has been possible in the case of the germinal cells; but its function is adequately explained as being that of a nourishing cell. In undescended testes of older patients in whom most of the spermatogenic cells have disappeared, the Sertoli cells are also frequently absent or distinctly atrophic, whereas the interstitial cells remain.

The failure of development of a normal spermatogenesis in the human cryptorchid has always been much of a conundrum and remained a matter of exceedingly interesting speculation until the researches of Carl Moore, of Chicago, demonstrated the scrotum to be a thermo-regulating mechanism. A temperature gradient of several degrees centigrade obtains between the interior of the abdomen and the scrotum. The latter does not exhibit the fat insulating layer possessed by the abdominal wall. External application of heat to the scrotal testis also causes a temporary aspermatic condition to develop. It has also been shown that, when testes of dogs elevated from the scrotum to the peritoneal cavity are returned to their normal position in the scrotum, the testes then become spermatic again (Fig. 1).

A comparison of the histological structure of the normal testes of prepuberty age with those that fail to reach the scrotum has failed to demonstrate any difference in most instances. It is also well known that the testis increases very little in size from birth to puberty. The accompanying tables indicate that, after the first year of life until about 13 years, practically no growth occurs in the testes.

Histologically, scrotal and undescended testes before puberty are very similar (Fig. 2). After puberty supervenes, however, the testis that has failed to reach the scrotum makes futile attempts to elaborate a mature germinal epithelium, but adult spermatogenic cells are not continuously

[1]Thesis presented before the Minneapolis Surgical Society, February 6, 1930.

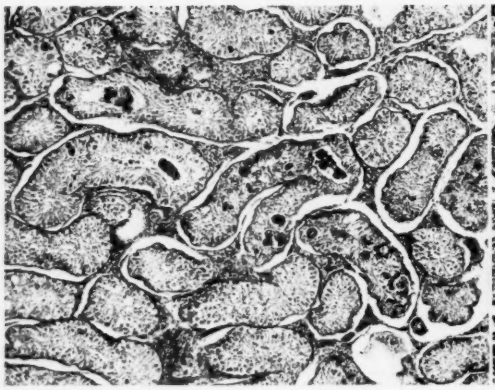


Fig. 1A.

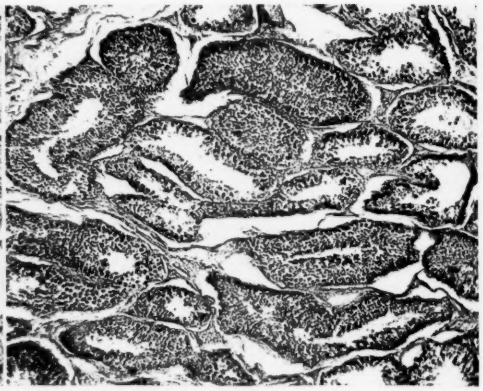


Fig. 1B.

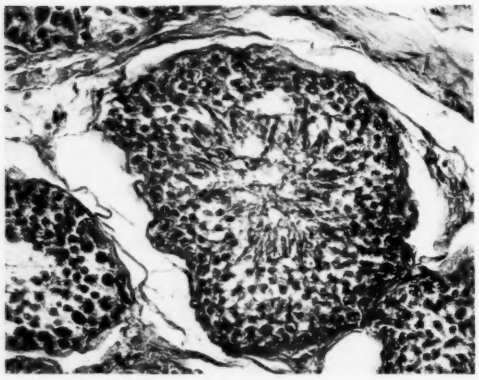


Fig. 1C.

Fig. 1. A, left. Right testis of adult dog after having been in the peritoneal cavity for 37 days. (×85). B, Left testis of same dog; also in the peritoneal cavity for 37 days but replaced in the scrotum at the time the right testis was removed. This section was made 190 days after the testis was returned to the scrotum. C, Same as B under higher magnification (×200); all the mature germinal cells including spermatozoa are present in abundance.

elaborated because body temperature outside the scrotum appears to be detrimental to the development of the testis (Figs. 3 and 4).

It must be freely admitted that the undescended testis is more likely to become malignant than the normally descended one. Cunningham, in 1921, found that in 452 cases of malignancy of the testis 40 concerned the undescended testis. When it is remembered, however, that only one patient in 500 possesses an undescended testis, it is at once apparent that malignancy in the testis that has failed to descend completely is about 50 times more common than the occurrence of malignancy in the normally descended testis. It is also known, that malignancy attacks the testis relatively infrequently. It is important to differentiate carefully between an abnormality or lesion in an organ and one which exhibits malignant change more frequently than does the normal. If the undescended testis is a precancerous lesion, a certain definite number of cases of a large series of undescended testes should eventuate in malignancy. It is also well known that large groups of cases of undescended testes have been observed over a prolonged period of time without an unusual number developing evidence of malignancy. Kocher is responsible for the statement that he observed but a single malignancy among 1,000 cases of undescended testes. Eccles observed 854 instances of undescended testes, in none of which did malignancy obtain. It must also be remembered that in about 20 per cent of the instances of undescended testes the deformity is bilateral. Certainly no one would advocate excision of both testes in the fear that malignancy might some day develop. When one considers the question of malignancy in this light, it must be conceded that even though the undescended testis is more likely to develop malignancy than the normal one, it is by no means a precancerous lesion. Scrotal fixation of the imperfectly descended testis, however, does not appear to lessen the increased likelihood of malignancy. Five instances reported in the literature have come to my attention in which malignancy developed in an undescended testis sometime following orchiopexy.

Another complication to which the inguinally retained testis appears especially predisposed is torsion. Its occurrence demands excision of the testis.

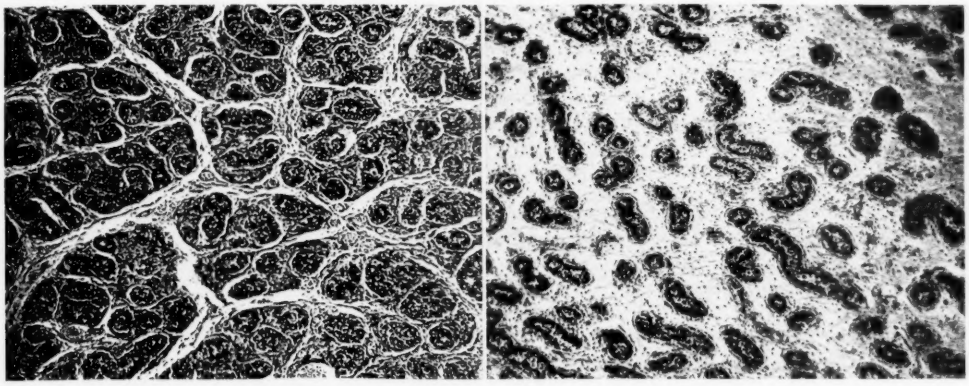


Fig. 2. Prepuberty undescended testes: At left, Abdominal testis of a 7 month old premature infant (×85). At right, Inguinal testis of an 11 year old child. The histological appearances of these testes are very similar. The mature germinal cells do not appear in the testis before the age of puberty.

DESCENT OF THE TESTIS

Just why the testis fails to reach the scrotum is not easily determined. Eccles classified the conditions which might be causative as follows: (1) conditions associated with the mesorchium; (2) conditions associated with the testis and its component parts; (3) conditions associated with the gubernaculum; (4) conditions associated with the cremaster; and (5) conditions associated with the route along which the testis must pass.

The testis develops in the retroperitoneal space and at birth in normally developed children is present in the scrotum in the majority of instances. The descent of the testis may be divided into three stages: the first two of which are entirely passive as concerns the testis. In the sixth week of fetal life, the genital ridge extends from the sixth to the twelfth dorsal segments, lying on the inner side of the wolffian ridge. During the third month of fetal life, owing to an atrophy of the cranial segments, the testis comes to lie in the iliac fossa; as a consequence of unequal rate of growth of structures below and above the inguinal ligament, the testis later may be found at the future internal abdominal ring. Preceded by the vaginal process of the peritoneum, the testis passes obliquely through the abdominal wall reaching the external abdominal ring during the seventh or eighth month. The scrotum and derivatives of the abdominal wall are preformed to receive the testis. At birth, or shortly after, the upper portion of the vaginal process becomes obliterated but the lower end persists throughout life as the tunica vaginalis propria. Failure of this peritoneal tunic to obliterate constitutes a potential inguinal hernia.

The mechanics of the passage of the testis through the abdominal wall remains unexplained. It has been said that the gubernaculum acting as a tractor drags the testis into the scrotum. Others have insisted that the gubernaculum serves as a rudder steering the testis into its proper location. Instances are reported in which the testis reached the scrotum in the absence of a gubernaculum, and R. H. Hunter[1] has recently stated that in the newborn the testis together with its fascial coverings may be lifted out of the scrotum without tearing anything but a little superficial connective tissue.

John Hunter insisted that the undescended testis was *ab initio* imperfect and believed that this imperfection accounted for the failure to descend. Hunter's opinion has claimed a large number of supporters. Bland-Sutton says, "The testis is retained because it is imperfect. The migratory impulse in the healthy normal testis is irresistible." Many have insisted that it is wrong to speak of atrophy of the undescended testis, believing it to be underdeveloped. Some have insisted that cryptorchidism is essentially a hypoplastic process representing only a portion of a general developmental disturbance. These conditions, however, have been adequately set aside by the labors of experimental workers.

Heredity seems to play a minor rôle in the failure of the testis to reach the scrotum. In the instance of a boy with bilateral retroperitoneal retention of testicles upon whom I operated, there were two other children in the family with undescended testes. In another family it has been my privilege to operate upon two brothers for

[1]Brit J. Surg., 1926, xiv, 123.

TABLE I.—AVERAGE WEIGHT OF TESTIS FROM BIRTH TO EIGHTEEN YEARS (MITA)

	Grams
Newborn	0.50
1 year	0.70
2 years	1.00
5 years	1.16–1.23
11 years	1.93
12 years	1.90
13 years	4.50
15 years	11.00
17 years	16.00
18 years	17.00

TABLE II.—AVERAGE WEIGHT OF TESTIS FROM BIRTH TO FIFTEEN YEARS (WWEDENSKY)

	Testis weight in grams		Epididymis weight in grams	
	Right	Left	Right	Left
Newborn	0.20	0.196	0.12	0.12
3 months	0.52	0.51	0.19	0.19
1 year	0.72	0.71	0.20	0.20
1 to 5 years	0.86	0.87	0.19	0.20
8 to 10 years	0.80	0.82	0.24	0.24
11 years	1.2	1.30	0.40	0.39
12 years	1.5	1.50	0.42	0.42
14 years	1.48	1.50	0.52	0.52
15 years	6.79	6.83	1.00	1.00

undescended testis, in one of whom the condition was bilateral. Uffreduzzi particularly has stressed the relation of heredity to the occurrence of undescended testes. Dr. W. E. Macklin, also a veterinary surgeon, informs me that out of 32 male pigs which he castrated for a farmer 12 of the group had undescended testes. Out of the litter from which the sire came, two brothers had undescended testes.

MacGregor[1] has recently stressed a third inguinal ring as frequently playing an etiologic rôle in cases of failure of descent; it is true that the majority of undescended testes are in the low inguinal region. The migration of the testis from the external inguinal ring into the scrotum seems to be an especially hazardous journey. (It is this area that MacGregor has designated as the third inguinal ring.)

ORCHIOPEXY

There are described in the literature about forty methods of bringing the testis into the scrotum; with the various modifications described by others, about 100 names may be enumerated as having contributed something to the elaboration of an adequate method of orchiopexy. Satisfactory operations on a given viscus ordinarily limit themselves to one or two procedures.

[1] Surg., Gynec. & Obst., 1929, xlix, 273.

TABLE III.—MEASUREMENTS OF TESTIS FROM BIRTH TO SIXTEEN YEARS IN TWO HUNDRED AND TWENTY-ONE BOYS (REICH)

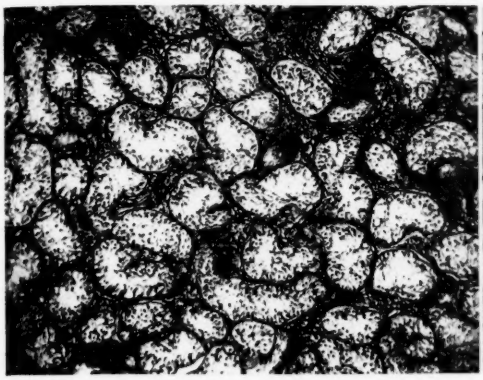
Age	Number of cases	Left		Right	
		Length cm.	Breadth cm.	Length cm.	Breadth cm.
0 to 1 month	6	1.5	0.7	1.6	0.8
1 to 2 months	7	1.6	0.8	1.6	0.8
2 to 3 months	11	1.6	0.8	1.6	0.8
3 to 4 months	7	1.6	0.8	1.6	0.8
4 to 5 months	4	1.7	0.8	1.7	0.8
5 to 6 months	6	1.7	0.8	1.7	0.8
6 to 7 months	4	1.6	0.8	1.6	0.8
7 to 8 months	5	1.6	0.8	1.6	0.8
8 to 9 months	5	1.6	0.8	1.6	0.8
9 to 10 months	4	1.6	0.8	1.6	0.8
10 to 11 months	5	1.6	0.8	1.6	0.8
11 to 12 months	7	1.6	0.9	1.6	0.9
1 to 2 years	28	1.7	0.8	1.7	0.9
2 to 3 years	13	1.6	0.9	1.6	0.8
3 to 4 years	10	1.6	0.8	1.6	0.8
4 to 5 years	5	1.6	0.8	1.6	0.8
5 to 6 years	6	1.7	0.9	1.7	0.8
6 to 7 years	14	1.7	0.9	1.7	0.9
7 to 8 years	11	1.7	0.8	1.7	0.8
8 to 9 years	13	1.5	0.9	1.6	0.8
9 to 10 years	8	1.7	0.9	1.7	0.9
10 to 11 years	11	1.7	0.9	1.7	0.9
11 to 12 years	8	1.9	0.9	2.0	1.0
12 to 13 years	7	2.3	1.2	2.3	1.2
13 to 14 years	6	2.8	1.4	2.8	1.4
14 to 15 years	6	2.8	1.4	2.9	1.5
15 to 16 years	4	3.5	2.0	3.6	2.0

The very fact that so many methods have been advocated indicates very plainly a general dissatisfaction with the operations of orchiopexy. Study has shown, however, that if the testis can be gotten into the scrotum before puberty it will probably go on and develop normally. Existing dissatisfaction with the methods of obtaining this end are largely matters of technical concern.

AGE FOR THE PERFORMANCE OF OPERATION

The results of recent clinical and experimental investigation indicate that the undescended testis should be gotten into the scrotum prior to puberty. Bevan[2] has recently urged the early performance of the procedure. It has been my

[2] Ann. Surg., 1929, xl, 847.



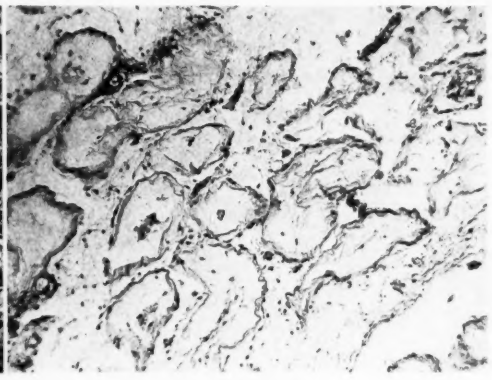
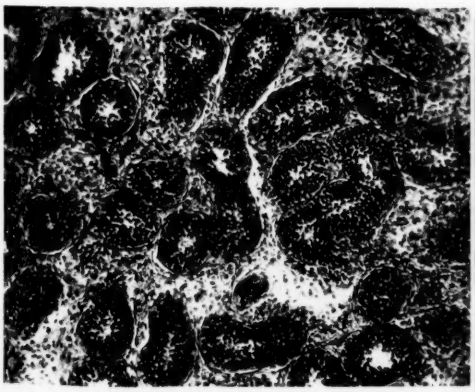


Fig. 3. At left, inguinal testis of a boy of 17 (×85); spermatogonia are present but the more mature germinal cells are absent. At right, inguinal testis of a man of 32; the interstitial cells are in evidence, but only the contours of the seminiferous tubules persist.

belief that the operation is well postponed until the child is 8 or 9 years of age at which time the structures in the spermatic cord have acquired larger proportions, thus facilitating the performance of the operation without injury to the delicate structures. Undoubtedly, however, as Bevan states, with practice the operation may be performed on the infant with little hazard. The instances in which descent may occur between birth and puberty are so few that the operation need not be postponed in the hope that the testis may spontaneously descend to its normal location. The undescended testis in the young, however, is immune to the histological changes observed in the post-puberty gland and the operation may well be deferred until 8 or 9 years of age. As far as I have been able to determine, the prepuberty imperfectly descended testis is usually in every particular much like its fellow in the scrotum. The testes of prepuberty dogs elevated into the peritoneal cavity fail to exhibit the changes observed in the adult dog's testis when transplanted in the same manner.

OPERATIVE PROCEDURE

It is usually the presence of a hernia that brings the patient with an undescended testis to operation. Whereas the visual deformity of cleft lip and palate ordinarily bring the patient to operation early, the little disturbance afforded by an undescended testis is responsible for so many cases seeking operation late in life, when the



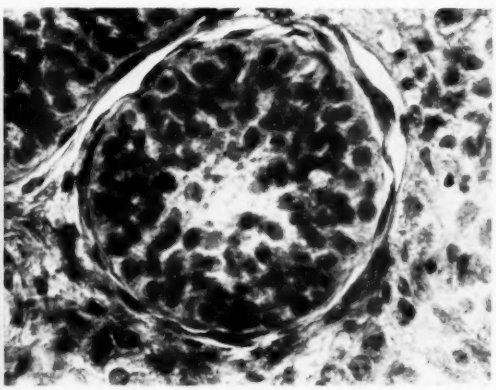


Fig. 4. At left, inguinal testis of a boy just over 13 years of age (×85); spermatogonia and spermatocytes are present in large numbers. At right, the same under higher magnification (×210); spermatozoa are not seen. Scrotal replacement should permit such a testis to elaborate a mature germinal epithelium.

Fig. 5A.

Fig. 5B.

Fig. 6.

Fig. 5. A, Photograph made upon dismissal from hospital after adequately mobilizing and placing an inguinal testis into the scrotum. B, The result 2 years after operation.

Fig. 6. A fairly satisfactory postoperative result had been obtained in this instance in which a strong silk suture attached to the tunica albuginea was passed through the scrotum and fastened to the thigh. However, after a year, considerable elevation has occurred as observed in this photograph.

occurrence of hernia brings them to the surgeon. In patients past 30 years of age, in whom the undescended testis is often completely atrophic, the same indication does not exist for anchoring the testis in the scrotum as obtains in younger individuals. It has been demonstrated for the rabbit and guinea pig, at any rate, that one-sixteenth of a normal testis suffices to permit the development of the secondary sex characters.

The size of the testis is a fair criterion of how it will react to being placed in its natural habitat. A small atrophic organ from which the germinal cells have disappeared will probably exhibit no growth; whereas, in a testis of fair size in a patient past puberty it may be assumed that the young germinal epithelium capable of elaborating the mature germinal cells still survive. In the prepuberty testis it must be recalled that the normally descended testis is also atrophic to palpation.

The development of the operation of orchiopexy is indelibly linked with the name of Bevan. The modern operation as it is known today is largely the result of his efforts. He has stressed particularly the fact that the separation of the vaginal process from the other elements of the spermatic cord, combined with the removal of the coverings of the cord, will so mobilize the testis that in most cases it may with ease be placed into the scrotum. A particular of paramount concern, however, is that such a testis, stripped of the cremaster muscle and all the fascial coverings, frequently retracts. Vessels are elastic and are no longer than they have to be and undoubtedly play a significant rôle in the subsequent elevation of the testis. At the time of operation the testis stripped of its fascial coverings may frequently be placed with comparative ease on the thigh below the bottom of the scrotum. On the completion of the operative procedure, the testis lies free at the bottom of the scrotal sac, but a few days later, when the wound is inspected, retraction of the testis out of the scrotum may frequently be observed. The scrotum also may play a part in this subsequent elevation. I have operated upon several cases by Bevan's technique, placing the testis in the bottom of the scrotum freed from all fascial connections, the testis remaining suspended by vessels and vas deferens alone. Much to my chagrin and disappointment the testis has later become elevated to a position high in the scrotum. Figure 5 illustrates such an occurrence. Later I was prompted to fix the testis to the bottom of the scrotum and passed a long suture of linen placed in the tunica albuginea through the bottom of the scrotum, anchoring this traction suture to the midthigh by adhesive tape to hold the testis on the stretch. The thigh was kept extended for 2 weeks, after which time the traction suture was cut and the patient was allowed up. The immediate result was better on the whole than when no traction was used at all. An examination of these cases after an elapse of time revealed the fact that the majority of them had retracted into the upper or midscrotum (Fig. 6); and comparison with the other testis indicated that it failed to show the same growth which occurred in the normal scrotal testis.

In recent years I have practiced an operation of my own design which might be described as a

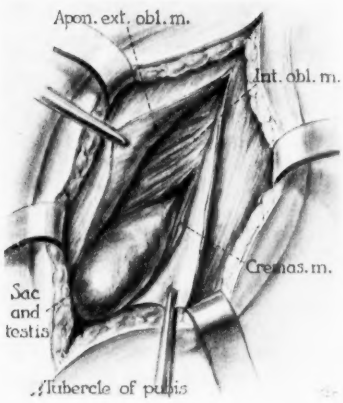


Fig. 7A.

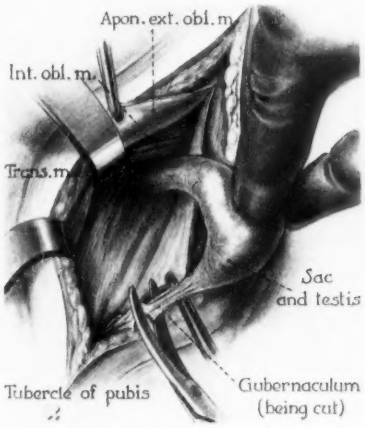


Fig. 7B.

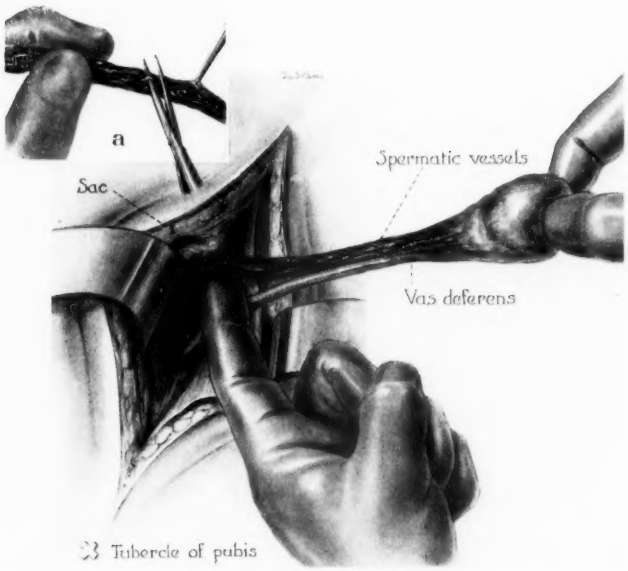


Fig. 8.

Fig. 7. A, Exposure of inguinal canal. The testis is shown at the external ring, the most frequent site of arrest of descent. B, The gubernaculum is cut free from its attachment. Care must be taken not to injure the epidydimis which is occasionally found separated from the testis in incomplete descent. The scrotum is dilated manually at this time and a small gauze pack is left in it.

Fig. 8. Isolation and separation of the hernial sac is the initial step in the operative procedure of gaining added length in the spermatic cord; occasionally this alone suffices. The next step consists in freeing the vascular bundle of the spermatic cord from its superficial fascial coverings. Employing the index finger as a dissector and with the testis under slight tension, considerable gain in length may be obtained by this maneuver of spermatolysis.

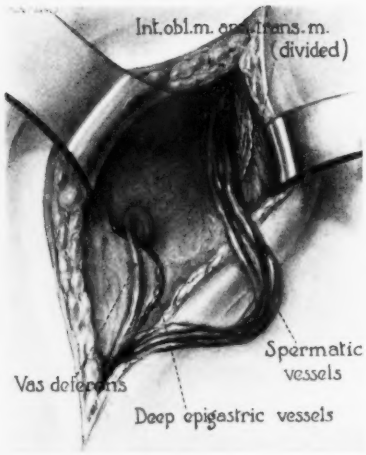


Fig. 9.

Fig. 9. If the testis still cannot be brought into the scrotum because of inadequate length of the vessels, the internal oblique and transversalis muscles are cut across. Splendid exposure of the retroperitoneal spermatic vessels is obtained by pulling the peritoneum medially at the upper end of the wound with a large retractor. The spermatolysis can be continued then well up toward the origin of the vessels, employing finger dissection and cutting of fibrous strands with scissors. If still short the vessels in the spermatic cord are shorn of every vestige of connective tissue.

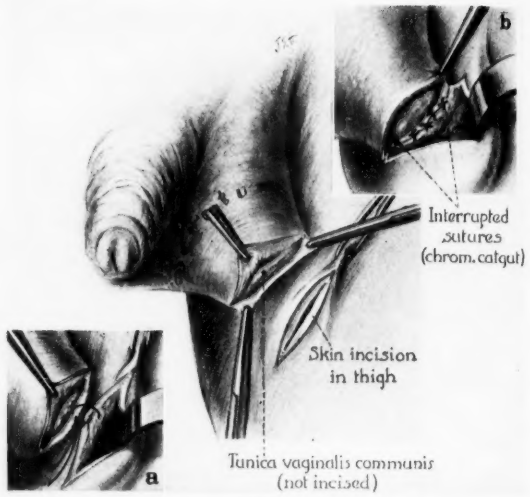


Fig. 10.

Fig. 10. Establishment of cutaneous juncture between scrotum and thigh.

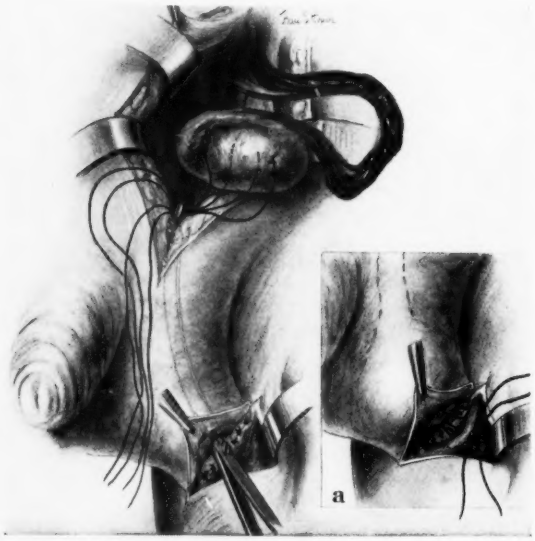


Fig. 11. Four anchor sutures of fine chromic catgut are placed in the tunica albuginea and brought down through the tunica vaginalis communis and fastened to the fascia of the thigh.

modification of the Torek procedure. The skin of the scrotum is sutured to the skin of the thigh and the testis is anchored to the fascia of the thigh but still remains within the scrotum. The accompanying sketches made of the operative procedure for me by Miss Jean Hirsch of the Medical Art Department of the University beautifully illustrate the details of the operation. These drawings are from sketches made at operation in the case of an adolescent well past puberty in whom the external genitalia were fairly well developed. After a period of 4 months or more the skin attachment of the scrotum to the thigh is severed. A subsequent study has indicated that these testes tend to remain in the low scrotal position and exhibit growth in agreement with that of the normal. In this method the skin attachment could remain throughout life if the patient desired; however, the desire on the part of the patient to preserve the normal cleanliness of the external genitals usually urges him to have this attachment undone. There is a point in the performance of this procedure that presents a few difficulties. The skin of the scrotum though not presenting

a thick insulating layer of fat exhibits between the skin and the tunica vaginalis communis a thin layer of fat. In some of the earlier cases in which I employed this method, this fat was dissected free from the skin resulting in a very insecure attachment of the skin of the scrotum to the thigh. The blood supply of the skin, as is well known, ramifies in this fat, and the detachment of the fat from the dermis would vitiate the healing in skin wounds anywhere. In effecting the union between the skin of the scrotum and the skin of the thigh this point should therefore be kept in mind. In making the incision into the scrotum this should extend down to, but not through the tunica vaginalis communis; this permits of a satisfactory suture and a firm union between scrotal and thigh skin. It is very important that the leg on the side operated upon be maintained in acute flexion for at least a week to preclude tension on the cutaneous union of scrotum and thigh. The remote results in cases in which this method has been practiced after detachment of the scrotal attachment to the thigh are uniformly good. The testis maintains a low scrotal position and the testis exhibits growth commensurate with the normal.

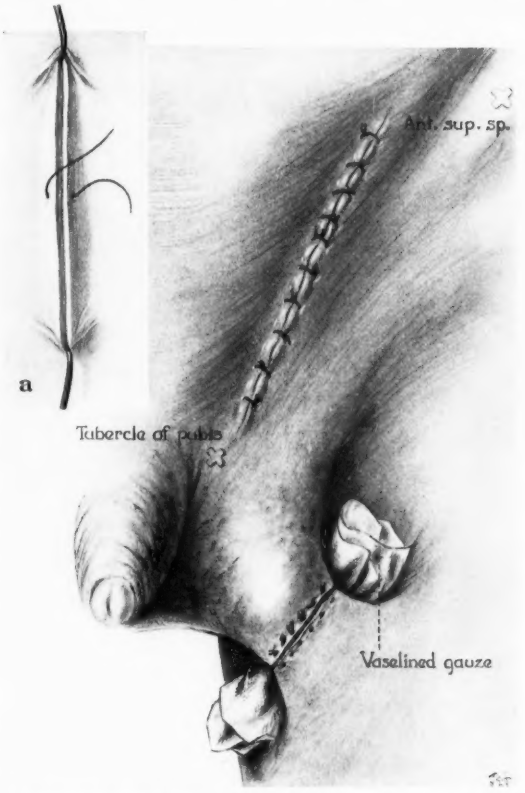


Fig. 12. The procedure completed. The thigh should be kept acutely flexed over a pillow for a week after operation.

TECHNIQUE OF OPERATION

Spinal anæsthesia is employed in adults and an ethylene ether sequence in children. An oblique inguinal incision is made from the tubercle of the pubis extending about an inch beyond the location of the internal abdominal ring. Not infrequently the testis is found just emerging from the external ring, in which event it must be carefully isolated before the external oblique aponeurosis is split. When the leaves of the external oblique aponeurosis are drawn aside and the inguinal canal is fully exposed, the testis usually comes into view (Fig. 7A). Occasionally when the testis is intra-abdominal it is not observed until the peritoneal tunic is isolated and pulled medially by a retractor.

After the spermatic cord is gently freed and isolated from the adjacent tissues, the testis is pulled upward putting the gubernaculum on tension. This attachment of the testis to the scrotum is then divided (Fig. 7B). Before division of the gubernaculum, however, it is well to ascertain whether or not the epididymis and testis are widely separated as occasionally occurs. It is a good plan at this stage to pass the fingers into the scrotum to stretch it out, and a large gauze sponge is left in the scrotum until the testis is fixed *in situ*. The hernial sac is then identified in its anteromedial position in the spermatic cord. After incision of the anterior wall of the sac, saline is injected beneath the posterior wall as suggested by Bevan to permit of easy mobilization. In young patients who have not had an actual hernia, the hernial sac is usually paper thin and must be handled with extreme gentleness to obviate tearing of the sac. I usually delay ligating the hernial sac until the spermatic vessels have been sufficiently mobilized to permit of easily placing the testis in the bottom of the scrotum.

The vas deferens is now identified and gently separated from the other components of the spermatic cord. Only rarely is it short. Simple division and ligation of the deep epigastric vessels will in such an event usually make the vas deferens long enough to reach the bottom of the scrotum.

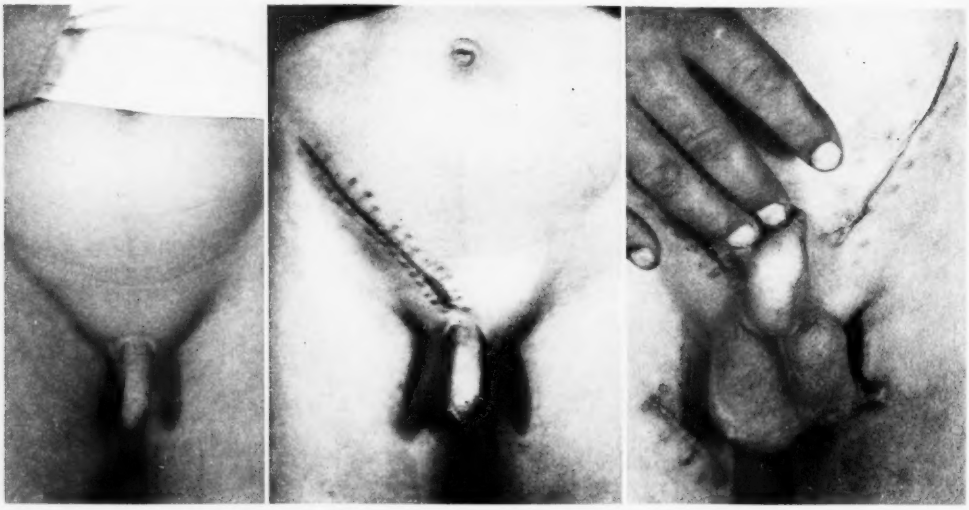


Fig. 13A. Fig. 13B. Fig. 13C.

Fig. 13. A, Boy of 11 years with bilateral inguinal retention of the testes. Photograph on entry to hospital. B, After orchiopexy of the right testis. C, Three months after the first operation. The patient has not yet returned to have the left scrotal attachment undone. It doesn't bother him but he intends to have the cutaneous union taken down when he can spare the time. Both testes have exhibited considerable growth since operation.

The initial step in lengthening the spermatic vessels, the component of the spermatic cord that is almost always short, is the separation of the hernial sac. The fascial coverings of the vessels are then teased out and cut, the testis meanwhile being kept under gentle tension (Fig. 8). If it is necessary, every vestige of connective tissue covering may be removed from the vessels so that each vessel stands out prominently, but I prefer to take away at first only the larger connective tissue bands.

It has been my experience that the freeing of the spermatic cord well into the retroperitoneal space, the forefinger being employed as a dissector, is a most valuable maneuver in gaining added length. Should the vessels still be too short to bring the testis to the bottom of the scrotum, the arched fibers of the internal oblique and the transversalis are cut across at the upper end of the wound, the incision extending medially for an inch (Fig. 9). A fairly broad retractor may then be inserted to pull the peritoneum forward and medially, permitting of the introduction of the hand into the retroperitoneal space. By this means the spermatolysis may be continued almost to the origin of the vessels. If the vessels are still short (a rare occurrence), the individual vessels in the spermatic cord are freed from every removable strand of connective tissue. This latter step is employed only as a measure of last resort, for not only are the vessels more likely to be injured in such a procedure, but the complete isolation may risk thrombosis of the vessels. It is better, of course, to return the testis to the retroperitoneal space than to section the vessels in order to bring the testis into the scrotum.

The testis having been adequately mobilized, four sutures are placed into the tunica albuginea of the testis, two on either side. I employ sutures of chromic catgut No. 00. An incision is then made through the skin of the scrotum down to, but not through, the tunica vaginalis communis; a similar incision is made in the thigh; and the skin of the thigh and scrotum are approximated posteriorly with interrupted sutures of fine chromic catgut mounted on a cutting needle (Figs. 10 and 11). A small curved hæmostat is then passed through the tunica vaginalis communis of the scrotum and the sutures previously placed in the testis are brought down. These sutures are now mounted on a Mayo fascia needle and sutured to the fascia in the thigh, the sutures placed opposite each other in the testis, being tied together. The skin of the scrotum and of the thigh are then approximated anteriorly by mattress sutures of silk (Fig. 12). On completion of

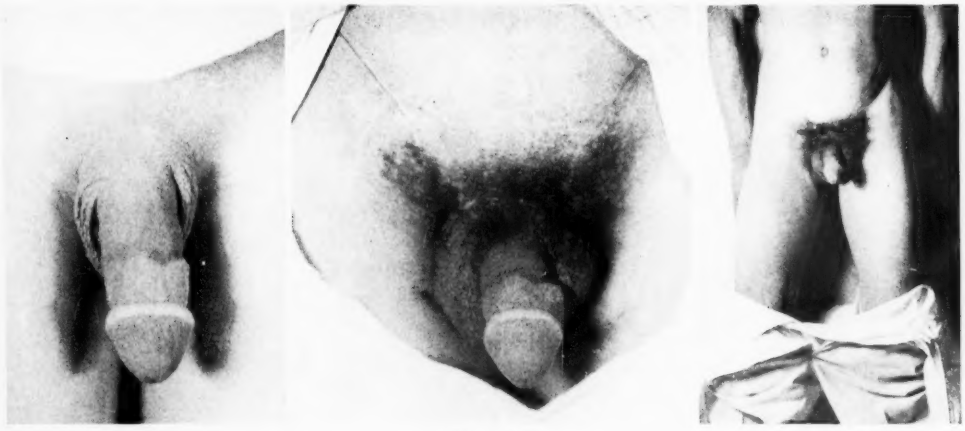


Fig. 14A. Fig. 14B. Fig. 14C.

Fig. 14. A, Boy of 15; photograph on admission; B, After replacement of both testes from retroperitoneal region into scrotum. C, 3 years later. Both testes in scrotum; left in midscrotum and not as large as right.

the operative procedure a strip of vaselined gauze is drawn beneath the new cutaneous union.

After ligature of the hernial sac, the hernioplasty is completed by approximating Poupart's ligament and the conjoined tendon and internal oblique over the cord. Transplanting the cord, as in the ordinary Bassini operation, lengthens the path of the spermatic vessels and shortens the cord and should be omitted. The external oblique aponeurosis is approximated by interrupted sutures as in the usual hernia operation and the skin is brought together with interrupted sutures of linen.

Division of the vessels in the spermatic cord leaving only the artery accompanying the vas deferens is to be condemned. Experimental as well as clinical study of the instances in which such a procedure is used shows that almost invariably atrophy occurs. The interstitial cells also disappear. Such a testis is no longer a gland but is only scar tissue.

RESULTS

Among the 30 patients[1] upon whom I have operated for undescended testis, one was excised because the patient demanded excision. In 2 other boys each aged 8 years, a testis was excised because it was found to be only a mere vestige at operation that could not even be definitely identified as testis. In both instances a normal vas deferens and spermatic vessels were present. Histologically, no evidence of seminiferous tubules was discernible in one and in the other only a few tubules were made out; in one the epididymis was histologically normal; in the other ducts also appeared abnormal. These observations are such an unusual occurrence in my experience that their description will be made the subject of a special report. One of these boys had bilateral failure of descent, and the other testis appeared quite normal and was anchored in the scrotum[2].

One was placed into the retroperitoneal space because the shortness of the vessels after most thorough mobilization precluded anchoring the testis in the scrotum. The vas deferens was divided and ligated to preclude retroperitoneal extension of infection should an epididymitis occur later in life. The division of the vas deferens of course, causes no demonstrable change in the histology of the testis. In this respect the testis differs from the other glands in which ligation or division of the excretory ducts almost invariably results in atrophy. In only 2 instances in this series was the vas of inadequate length. Simple division and ligation of the deep epigastric vessels sufficed to make the vas in each instance adequately long. A hernial sac was present in all instances in this series; in one case, however, the sac was obliterated at the upper end. In several instances no hernial content had ever become engaged in the sac. In 6 of the 30 instances the testis and epididymis were more or less separated.

[1] Five of these patients were operated upon since this paper was presented, February 6, 1930.

[2] It may be repeated here that the size of the testis is a fair index of its histology, bearing in mind, of course, that the testis exhibits but very slight growth from birth to puberty.

Fig. 15.

Fig. 15. Boy of 9 years; after detachment of the scrotal attachment. The testis on the side operated upon hangs lower than the normally placed scrotal testis on the left.

Fig. 16A.

Fig. 16B.

Fig. 16. A, Orchiopexy for inguinal retention. A piece of gauze has been drawn beneath the scrotal and thigh cutaneous juncture. B, Eighteen months later.

Whereas, ordinarily the epididymis caps the testis, such a separation may also be observed in the normal, but not with the same frequency as it occurs in the undescended testicle.

Seven patients in this series were more than 15 years of age; one was 28, another 26; 2 were 21; 5 were between 14 and 15 years of age. The others were under 13; the youngest was 3 and the next youngest 7. The larger number were between 8 and 17 years of age. Five exhibited bilateral failure of descent. In one of these both testes were intra-abdominal, but with persistent effort the testes were brought into a low scrotal position (Fig. 14). Examination, 3 years later, shows the result to be quite satisfactory. The right testis lies low in the scrotum and is of normal size; the left is somewhat high and is only half as large as the right.

In most of the bilateral cases, both sides have been operated upon at the same sitting; in one instance of unilateral failure of descent in which the vessels proved of inadequate length after thorough mobilization, the testis was fixed high in the scrotum and later anchored at a satisfactory position at the bottom of the scrotum.

Of the 20 cases operated upon by the technique described in this paper, a uniformly good result has been obtained in almost every instance. In a few of the early cases in which flexion of the thigh was not strictly observed and in which the approximation of the skin of the thigh and scrotum was imperfect because of the separation of the thin layer of fat from the scrotal skin in effecting the suture, early detachment of this union occurred permitting of retraction of the testis into the upper scrotum.

The experience gained with the operation of orchiopexy in this series of cases has demonstrated to my own satisfaction that protracted anchorage of the testis is an important and significant detail for the complete success of the procedure. Only a testis which remains low in the scrotum will exhibit the growth of which the normal testis is capable.

It has been my privilege to see the happy end-results in two other types of operative procedure that I have not had occasion to practice. Herbert Meyer[1] in a recent paper has indicated the splendid results obtained by the Torek operation in

[1]Surg., Gynec. & Obst., 1927, xliv, 53.

which the testis is temporarily placed in the thigh and later returned to the scrotum. In a few foreign clinics, it has been my good fortune to see the remote results following the establishment of an artificial synorchidism (Mauclaire's procedure) in which the imperfectly descended testis is brought through the scrotal septum and anchored to its fellow. Many who have practiced this procedure express complete satisfaction with the results obtained with method.

SUMMARY

The imperfectly descended testis is aspermatic because of its position. Prior to puberty the undescended testis is in every respect much like its normal fellow in the scrotum. The scrotum serves as a thermo-regulating mechanism, and in the adult only a scrotal testis is normal. The undescended testis is more likely to become malignant than is the normally descended one and scrotal fixation does not diminish this increased predisposition to malignancy. The undescended testis, however, is not a precancerous lesion and it is true that testicular malignancies are infrequent.

The procedure of election in the treatment of failure of descent is placement of the testis into the scrotum without injury of the testicular blood vessels. Adequate mobilization of the vessels of the testis (spermatolysis) is a significant and essential factor for the success of the procedure. In the operation of orchiopexy, temporary scrotal anchorage is an important detail of the technique. Without adequate scrotal fixation, retraction occurs, and growth of the testis commensurate with the normal does not obtain. A method to secure this end is described. The optimum time for the performance of the operation is between 8 and 11 years; to insure a good functional result it is important that the operation be done before puberty.

NOTE.—A fairly complete bibliography is to be found in my paper "The Undescended Testis; an experimental and clinical study." Ph. D. Thesis, University of Minnesota, December, 1925, also reprinted in the *Archives of Surgery* March, 1927.

GAS GANGRENE IN CIVIL LIFE

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From the Surgical Department of the Cincinnati Medical School

GAS gangrene assumed great importance during the World War because of its great frequency. However, it is a disease which has been known for many years in both civil and military practice. Hippocrates, writing of a case of gangrene, though it is not clear that it was of the emphysematous variety, said, "Criton of Thasa commenced to experience pain in his foot, in his great toe. . . . He went to bed the same day. He had a slight chill, some nausea, and then a little fever; he became delirious during the night. On the second day there was swelling of the entire foot and over the whole ankle, which was a little red and tender; there were present tiny black blebs and he had a great fever. The sick one was completely out of his head. There were frequent evacuations of bilious matter. He died the second day after the onset of the illness . . ." Celsus is thought by some to have known of the occurrence of gas gangrene in pregnancy; for in his chapter on the extraction of the dead fetus we find, "It may so happen that the child may be distended with a humor, from which there flows a fluid with a fœtid odor."

Following these early writings there is a long period during which the disease seems not to have been recognized. Avicenna, Guy de Chauliac, J. de Vigo, and Ambrose Paré do not refer to it (Trifaud). But in Fabricus de Hilden's works (*Opera Omnia*, Frankfort, 1746) we find mention of gas gangrene. "It is my belief," he says, "that the principal cause of this terrible ill is some venomous humor which Nature has driven into these people."

Quesnay, in 1745, in a chapter on "Gangrene of putrid dissolution of the humeral mass," gave Peyronnie the credit of being the first to describe and to furnish exact observations on gas gangrene, and spoke of "The subcutaneous emphysema, the erysipelatous color of the skin, and the rapidity of death. . . ." We find that De la Motte, in 1771, published two observations which have been accepted by some as possible cases of gangrene. In 1786, Thomas Kirkland knew and called it gangrene of the "emphysematous type."

Early in the nineteenth century, Larrey, during the Napoleonic wars, seemed to have known this infection. In some of his observations he spoke of the rapid progress of traumatic gangrene which in a few hours spread from the injured limb and was often fatal in less than 10 hours. Boyer, in 1814, mentioned its occurrence in fractures and also spoke of the rapidity of death, while Velpeau, in 1829, stressed it as a complication of fractured limbs, and considered the emphysema of grave significance. In his experiences, death was the outcome in many cases. Dupuytren, in his lectures under the name of "spontaneous emphysema," described a condition occurring in trauma resulting in rapid decomposition, and, in 1836, we find Martin de Bazas publishing a case of foudroyant gangrene which followed a crushed foot and in which death occurred in 12 hours. Malgaigne recalls a case of rapid termination after emphysema complicating a fractured limb. He looked for the real cause. "I think," he declared, "that there occurs under the influence of shock and stupor a special change which attacks life just as an excessive cold will kill the sperm in an egg and which will destroy the vitality of a blood clot without any appreciable changes in the appearance." For the first time the gas escaping from the emphysema was analyzed. It was found to be inflammable and it constantly showed the presence of hydrogen sulphide. Trifaud states that Renaut and Chauveau were among the first to create gangrene in experiments upon animals.

At the meeting of the Academy of Sciences on October 11, 1849, Chassaignac asserted that certain gangrenes with emphysema should be considered as having "a poison far in excess of the mechanical injury." He described 4 cases the next year which showed what he called "empoissonnement traumatique." Maissoneuve reported to the Academy at a later date (September 12, 1853) 2 cases of gas gangrene and declared there existed a certain variety of traumatic gangrene to which he gave the name of "gangrene foudroyante" in which, first, putrefying gas developed in the interior of veins during life; and second, that this gas circulated in the blood and caused a fatal poisoning. Later, in developing the doctrine of "pneumohæmaturia" (pneumohæmia) he considered this as a variety of septicæmia.

During the Crimean War, Pirogoff, with the Russian, and Salleron, with the Allied Forces, both noted this condition and wrote about it.

Dolbeau emphasized the idea that the "autoinfection" is always fatal and declared himself

strongly in favor of immediate amputation. Billroth busied himself for a time with it. He considered the cause to be the decomposition of the mortified elements occurring in the disease. These products apparently were able to diffuse so rapidly that he thought that they might be caused by the action of some ferment. Gurlt discussed it in his monumental work on bone surgery (1862).

In the American Civil War, there is no record of gas gangrene as such. In fact, Keen, who served as a military surgeon, stated that he never saw a case. It was, however, observed in the Franco-Prussian War. Wyatt observed it at the siege of Paris. Frery mentioned it as occurring in Belfort (Trifaud). Passow declared that it was discussed at a meeting of the German military surgeons in Orleans.

With the appearance of the "Bacteriological Era," the organisms found associated with the disease were investigated by various workers. Pasteur discovered the vibrion septique; Novy the bacillus œdematiens; Koch the bacillus of malignant œdema; and Welch the gas bacillus (bacillus welchii). Fraenkel, von Hibbler, and, more recently, Weinberg have been outstanding workers in this field. The clinical aspect of this disease has been investigated and described by Stolz (1902), Stewart (1905), Cramp (1912), and Simonds (1915).

During the World War great interest was aroused in the disease and the literature which appeared during the years 1914–1918 was prodigious. Among a great number of papers perhaps the best articles are the Surgeon General's Report, (U.S.A.), the Report of the Medical Council of Great Britain, and Coenen's monograph on "Der Gasbrand."

ANALYSIS OF CASES OF GAS GANGRENE IN CIVIL LIFE

A series of 607 cases[1] occurring in civil life[2] have been collected and subjected to analysis.[3] Obstetrical infections have not been included, although there have been a fair number of these reported in the literature (Bruett, Little, Nurnberger, and Ingles among others).

Only those reported subsequent to the Lister era are taken. In his excellent monograph on this subject Trifaud has 123 cases before 1883. These have been omitted. Neither have cases been counted which fail to contain clinical data. Sordelli, of Argentina, for example, mentions that he had seen 11 cases, but discusses them from a bacteriological aspect. Neither are those cases included in which the diagnosis was made after death or found at the autopsy table. This rules out the possibility of bacillus welchii developing when decomposition commences. Several other quite questionable cases are also omitted.

[1] It must be realized that there are many more cases occurring throughout the world than are reported. This series is perhaps not a fair cross section because of the human tendency to report the bizarre and apparently unusual conditions.

[2] Gas gangrene is not listed as a cause of death in the Bureau of Census Mortality Tables of the Registration Area in continental United States.

[3] The total number of cases previously reviewed were: Stewart, 61 cases (1905); Cramp, 187 cases (1912); Simonds, 175 cases (1915). Each included in his series the work of his predecessor. The writer has added over 400 more.

TABLE I.—MORTALITY

	Cases
Grand total studied	607
Total recoveries (50.3+%)	291
Total deaths (49.7−%)	287
Total with known outcome	578
Total with result unknown	29

Mortality. The American Expeditionary Force in France had a death rate according to The Surgeon General's Office of 48.52 per cent. Of the 128,265 wounds of the soft parts recorded, 1,389 developed gas gangrene, 1.08 per cent. This excluded chemical warfare gases. There were 674 deaths.

The official British Expeditionary Force report gives an "Incidence of 1 per cent . . . which constituted a serious loss on account of the high mortality of 20 to 50 per cent. The number of cases varied in the big pushes, and when the wounded were not treated quickly, it was of course higher."

TABLE II.—SEX INCIDENCE

	Total	Per cent
Males	395	.....
Recovered	201	50.9−
Died	194	49.1+
Females	69	.....
Recovered	33	47.8
Died	36	52.2
Unclassified	114	.....
Recovered	57	50.0
Died	57	50.0
Unclassified as to sex or to result		29

TABLE III.—AGE INCIDENCE

Age	Total	Recovered No.	Recovered Per cent	Died No.	Died Per cent	Result not stated
0 to 9	34	18	58.1−	13	41.9+	3
10 to 19	77	43	58.1	31	41.9+	3
20 to 29	89	48	55.2	39	44.8	2
30 to 39	76	40	55.5	32	44.5−	4
40 to 49	62	20	33.9	38	66.1	4
50 to 59	46	19	43.2	25	56.8	2
60 to 69	29	8	27.6	21	72.4	0
70 to 79	7	4	57.0	3	33.0	0
80 to 89	0	0	....	0	....	0
Not stated	187	92	52.3	84	47.7	11
Totals	607	392		286		29

Symptoms. The two main symptoms of gas gangrene are crepitus and discoloration. Discoloration was noted in 226 cases and crepitus in 235 cases as shown in Table IV.

TABLE IV.—SYMPTOMS

	No.	Approximate per cent
Discoloration noted on the first day	82	36+
Discoloration noted on the second day	86	38+
Discoloration noted on the third day	27	12+
Discoloration noted on the fourth day	31	13+
Total	226	
Crepitus noted on the first day	60	25+
Crepitus noted on the second day	93	39+
Crepitus noted on the third day	37	15+
Crepitus noted on the fourth day	45	19+
Total	235	

Bacteriological examination. Table V shows the result of the bacteriological studies which were made, and which were not very accurate. In many cases the bacillus welchii was the only organism that was looked for and the only one that was cultured; doubtless there were many more mixed cultures present.

TABLE V.—ORGANISMS FOUND

	Cases
Bacillus welchii	231
Organism described as "anaerobe"	32
Bacillus welchii plus streptococci	25
Bacillus of malignant œdema	13
Bacillus welchii plus streptococci and staphylococci	6
Bacillus welchii plus cocci	3
Vibrion septique	1
Bacillus welchii plus miscellaneous bacteria	19

Fractures. The relation of gas gangrene to fractures is well known. In the American Expeditionary Forces in the 25,272 cases which included bone fracture, there were 1,329 cases of gas gangrene.

In this series of 607 cases, there were 227 bone fractures, 143 of which were compound. It is thought by some that the calcium salts liberated by the disintegration of devitalized bone substance tends to lessen the resistance to anaerobes. Certain investigators have found that the presence of certain calcium salts aids in the production of gas gangrene. Whatever the reason may be, traumatized bone itself causes marked injury of the body substance and adds to the damage already done. The fact that the bone fragments may be deeply embedded in the middle of the muscle away from the air makes for a favorable focus.

TABLE VI.—RELATION OF GAS GANGRENE TO FRACTURES

	Total number of fractures	Compound
Skull	1	0
Shoulder and clavicle	1	0
Humerus	24	17
Radius and ulna	27	17
Ulna	6	4
Radius	6	2
Femur	35	15
Tibia	43	39
Fibula	6	3
Tibia and fibula	34	24
Bone of the foot	9	3
Bones of the hand	3	1
Spine	1	0
Pelvis	4	1
Patella	4	3
"Broken leg"	13	10
"Broken forearm"	8	4
"Fractured ankle"	2	0
Total	227	143
Per cent	37.4	23.5

Seasonal occurrence. Table VII gives the number of cases by months.

TABLE VII.—SEASONAL OCCURRENCE

	No.	Per cent		No.	Per cent
January	28	8	July	30	9
February	31	9	August	15	5−
March	37	11	September	21	6
April	18	5	October	21	6
May	31	9	November	32	10−
June	31	9	December	31	9
Total known				326	
Not stated				281	

The condition is found in all parts of the world; cases have been reported from most of the countries of Europe and North America; from Russia, Turkey, Africa (Algeria), South America (Argentina and Uruguay), Australia, New Zealand, Oceania, and the Philippine Islands.

TABLE VIII.—PREDISPOSING CAUSES

	Cases
Gunshot wounds	58
Falls	54
Vehicular (excluding railroad)	53
Operations	48
Etiology not known	25
Railroad accidents	25
Injections	24
"Machinery"	17
Gangrene of diabetes mellitus	12
Abscesses	10
Gangrene, not diabetic	7
Miscellaneous (bites, gorings, etc.)	32
Not stated	242

Predisposing causes. Table VII is probably not an entirely accurate picture as to the causal dis-

tribution. Cases following operative procedures and injections have often been of unusual interest and so have been reported for that reason.

TABLE IX.—GAS GANGRENE FOLLOWING OPERATIONS

	Cases
Appendectomy	8
Genito-urinary operations	5
For neoplasm	4
Aneurisms	3
Miscellaneous (rectal, suspensions, etc.)	17
Not definitely stated	8
Hernioplasty	3

TABLE X.—SITE OF INJURY

	Cases
Head	8
Neck	5
Trunk	76
Arm	50
Elbow	5
Forearm	47
Wrist	2
Hand	14
Thigh	65
Leg	150
Knee	2
Foot	32
Scrotum	8
Perineum	4
Listed as "upper extremities"	3
Listed as "lower extremities"	8
Listed as "extremities"	61
Not stated as to location	67

TABLE XI.—SUMMARY

	Cases	Approximate percentage
Listed as "extremities"	61	11.3
Upper extremities	121	22.6+
Lower extremities	257	47.6+
Trunk and genitalia	88	16.3+
Head and neck	13	2.4+
Total known	540	

Treatment. In Table XII are listed the methods of treatment and their results.

The cases which were treated with pure oxygen, charcoal, rivanol, Pilcher's solution, etc., are insufficient to make any fair analysis.

Relation of bacillus welchii to appendicitis. There are many conflicting ideas as to the importance of bacillus welchii in appendicitis. Jennings stresses the fact that it may be of value to employ serum in acute cases with localized, spreading, or general peritonitis. When a smear is found to be positive for bacillus welchii he recommends and uses intravenous serum. He also favors this in gunshot wounds of the bowel. On the other hand, Simonds and Dudgeon with Sargeant, do not believe that anaerobic bacteria play such an important part. The two last argue that if the bacillus aerogenes capsulatus were prevalent, emphysematous gangrene of the bowel would be seen very much more frequently in people dying of appendicitis.

TABLE XII.—TREATMENT

	Totals	Recovered Cases	Recovered Per cent	Died Cases	Died Per cent	Not stated
Amputations	128	71	58.7	50	41.3	7
Incision and drainage (including débridement)	125	57	47.1	64	52.9−	4
Amputations plus serum	40	19	47.5	21	52.5	0
Amputations plus incisions	38	28	77.7	8	22.3−	2
Serum	22	15	68.2−	7	31.8+	0
Serum plus incisions	22	17	81.0−	4	19.0+	1
Amputations plus incisions plus serum	15	7	50.0	7	50.0	1
Miscellaneous (rib resections, charcoal, etc.)	9	4	44.4−	5	55.5	0
Number not stated and not surgically treated	208	73		121		14
Totals	607	291	50.3	287	49.7	29

Irrigations:

	Cases	Results: Recovered Cases	Recovered Per cent	Died Cases	Died Per cent	Unknown
Hydrogen peroxide	47	33	70.2	14	29.8	0
Dakin's	37	24	66.6	12	33.3	1
Dakin's and hydrogen peroxide	4	4		0		0

X-ray diagnosis. The fluoroscope and X-ray are valuable early instruments of diagnosis. Indeed, Savill goes so far as to say that the roentgen-ray picture will show the various kinds of gas. She declares that bacillus welchii and vibrion septique (among others) have their peculiar diagnostic characteristics.

Use of oxygen. Oxygen has been tried in several ways: (1) by allowing the gas to penetrate the wounded tissue by inserted tubes; (2) by injecting the oxygen into the wound and into the tissues in front of the progressing infection. The German War surgeons declare this latter dangerous and cite cases of fatal air embolism. They (Frankenthal, Gaertner, Simmonds) warn against this.

Relation to diabetes. It is of surgical interest to bear in mind that glycosuria may be present (Rose), and that cases have been known to have followed amputation for diabetic gangrene (Linton).

A list showing authors' names and number of cases collected from the literature is appended.

Adams, 1; Albrecht, 5; Anshutz, 2; Baldwin and Gilmore, 6; Barney and Heller, 1; Baugher, 4; Benton, 2; Berton and Tolk, 2; Bill, 1; Black, 12; Blake and Lahey, 10; Bloodgood, 9; Boland, 18; Borchard, 1; Braatz, 1; Brabec, 1; Brieger and Ehrlich, 2; Bremer, 1; Brentano, 2; Brickner and Milch, 3; Bruett, 1; Bunge, 1; Butler, 2; Camperon, 12; Chavigny, 1; Christopher, 1; Clark, F. H., 1; Clark, J. J., 1; Clifton, 1; Cochois, 1; Cole, 1; Cramp, 25; Curtis, 1; d'Agata, 4; Dandy, 1; Dansauer, 1; Dayton, 1; Delacourt, 1; deQuervain, 1; Dickinson and Travers, 2; Dodeau, 1; Durham, 5; Duvergery, 1; Eagleton, 1; Eckhoff, 21; Ellis, 1; Elvins, 1; Erdmann, 1; Evans, 1; Falkenburg, 1; Ferguson, 1; Ferraton, 3; Flechenmacher, 3; Fortuine and Vickers, 3; Fraenkel E., 4; Fraenkel and Wohlwill, 4; Gage, 4; Gemmill, 4; Gilpatrick, 1; Goodman, 1; Gosman and Williams, 2; Greeley, 2; Gros, 2; Guildersleeve, 2; Guillemont, 5; Guthrie, 8; Gwyn, 1; Hahn, 1; Halle and Marquezy, 1; Hardy, 3; Harnig and Silberschmidt, 3; Harttung, 1; Heaton, 1; Hendry, 4; Henke and Batzdorff, 1; Heuss, 1; Hewitt, 10; Heyde, 3; Hilgenfeldt, 1; Hitschmann and Lindenthal, 1; Hitzrot, 1; Hoffman, 1; Hotchkiss, 1; Jeandidier, 1; Joseph, 2; Kamen, 1; Kemkes, 1; Kirchmayr, 5; Klemm, 1; Kling, 4; Klotz and Holman, 36; Knauer, 1; Larson and Pulford, 7; Learmouth, 1; Leboutillier, 3; Lecene and Legros, 2; LeDentu, 1; LeRoy, 1; Linton, 6; Loeb, 1; Love, 1; McGill, 1; Mann, 1; Mason, 1; Massari, 1; May and Gebhardt, 1; Melchior, 2; Meneruel, 1; Millar, 27; Milward, 2; Monroe, 3; Morris, 2; Mouchet, 1; Muscatello, 5; Nicholls, 1; Norris, 1; Oschner and Schmidt, 1; Page, 2; Pantzer, 1; Passow, 1; Perrin, 1; Pettermand, 1; Pilcher, 1; Pinneo, 1; Potherat, 2; Poullam, 2; Ragnault, 1; Reifschneider, 2; Rendu and Rist, 3; Ritzman, 4; Roantree, 1; Roberts, 2; Roberton, 6; Rochi, 1; Rose, 1; Rothfuchs, 2; Schar, 1; Schmidt, 2; Schwarzer, 1; Sargeant and Dudgeon, 4; Seydel, 1; Shearer, 1; Siebner, 6; Slater, 1; Smith, G. A., 1; Snyder, 1; Stewart, 2; Tanner, 7; Tenopyr, 8; Thorndike, 2; von Dungern, 1; von Hibbler, 11; von Seeman, 1; Wanke, 2; Weinberg and Francon, 1; Weintrob and Messeloff, 85; Welch and Flexner, 7; White, 8; Wicklein, 3; Widal and Nobelcourt, 1; Wolff, 1; Wright, 1; Wolffe, 1; Young and Rhea, 2; and Zeissler and Neller, 21.

SUMMARY

1. It is shown that gas gangrene was known long before the middle of the last century, when it was again brought to modern attention by Salleron, Maissoneuve, and others.

2. Six hundred and seven cases occurring from the beginning of the "post-Lister" period to the present (1930) have been collected and subjected to analysis. This does not include obstetrical cases.

3. The mortality of these collected cases was 49.7— per cent and that of the American Expeditionary Force in France was 48.52 per cent.

4. There were 227 fractures of which 143 were compound.

5. The therapy is discussed. The small number of cases prevents any definite conclusions.

In conclusion, thanks must be given to the kindness and co-operation of the Library of the Cincinnati General Hospital and to the Surgeon General's Library of Washington; and to Dr. George J. Heuer for his advice and help.

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A COMPARATIVE STUDY OF TUBERCULOUS LESIONS OF THE UROGENITAL TRACT

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ALTHOUGH tuberculosis of the urogenital tract is commonly thought to be well understood, there are perhaps still some aspects from which new information of practical value may be derived. In meditating on the problem we have been impressed with the following facts: first, the difficulty of arriving at an absolute diagnosis clinically; second, the difficulty of arriving at a complete diagnosis from either surgical or postmortem material; and third, the need for a correlated study of clinical, pathological and bacteriological findings in genito-urinary tuberculosis. By such a procedure only will we be able to form a correct opinion of the onset, progress, and termination of the disease in all its manifestations.

Urologists generally possess well crystallized ideas regarding genito-urinary tuberculosis that is commonly met with. The general opinion seems to be that the disease is most commonly hæmatogenous, involving one kidney first or one epididymis with a spread from these points to other parts of the tract. Variations from these routes occur, but are considered of minor importance. Statistics on the subject may be of some help.

The incidence of genito-urinary tuberculosis depends upon the type of patient. In pulmonary tuberculosis, Huebner states that 3 to 5 per cent reveal genito-urinary lesions while 50 to 70 per cent of extrapulmonary tuberculosis have urogenital tuberculosis. Fowler and Godlee found genito-urinary involvement in 5.27 per cent of pulmonary tuberculosis; Krzynicki 5 per cent; Hesse in over ten thousand tuberculous cases found only 2.13 per cent with genito-urinary tuberculosis. Of the various parts of the genito-urinary tract involved, Scott quotes various authors to show that about 60 to 75 per cent of genito-urinary tuberculosis involves the prostate but is mostly secondary to infection elsewhere in the genito-urinary tract. The kidney and epididymis perhaps will show a similar percentage although no definite figures are given. Relative to pulmonary involvement in genito-urinary cases, Scott cites references to show that from 27 to 80 per cent of genito-urinary cases have pulmonary disease. Perhaps all who do not have it will develop it before death if they die from this disease.

Of all the forms, renal infection is considered to be of the most importance. This is perhaps due to the fact that it is the earliest identified. A few opinions will be cited on this phase of the subject.

Hammond considers that 92 per cent of renal tuberculosis appears first in one kidney by the hæmatogenous route. It begins either in the apex of the papillæ or at the cortico-medullary junction. It may spread to the other kidney by vesical or ureteral extension. Pathologically, there are three types: the ulcerocavernous with constant urinary findings and no enlargements; the hydronephrotic with enlargement and intermittent urinary findings; and the caseous in which no urinary findings may be present. Although Vaccaro considers the possibility of a tuberculous genito-urinary infection arising from bacilli that have passed the respiratory passages without lesion, the most likely origin is from some remote focus of infection. Nitch divides renal tuberculosis into two groups, surgical and medical, depending on the origin. The former arises from some latent focus, while the latter arises from some other massive involvement elsewhere, is bilateral, and is at no time surgical. He states that many times the surgical variety is also bilateral from its inception as animal inoculation will frequently reveal. Animal inoculation, however, is not entirely dependable, as shown by Morse and Braasch. They found that the guinea pig test was negative in 17.7 per cent of proved cases of renal tuberculosis and positive in 18 per cent of kidneys that were thought to be normal mates to tuberculous kidneys. They agree with Medlar and Sasano that excretory bacillosis is negligible and attribute the positive findings to a possible ureteral "reflux."

Relative to the early symptoms of renal tuberculosis, Beer summarized 100 cases and found that 9 to 12 months elapsed from the beginning of the typical symptom complex before the condition was diagnosed. It is more in males than females; more on right than left; nearly always hæmatogenous; begins in papillæ and extends to pelvis, ureters, and bladder, sometimes causing stricture with resulting hydronephrosis and secondary infection. Runeberg analyzes 213 cases of renal tuberculosis, 123 of which had a nephrectomy.

There were symptoms for more than a year in 55 per cent before tuberculosis was suspected. The symptoms were mostly of an insidious nature such as frequent urination; lumbar pain was much less frequent, and hæmaturia, pyuria, and emaciation were rare. Incidentally, he claims good operative results. Bugbee points out that the insidious nature may be due to a low grade infection capable of healing without detection. This may help explain the "auto nephrectomies" reported by Allemann, Wolff, Randall, and others. Joly believes, however, that some so called "spontaneous" cures are due to a shutting off of the kidney by stricture but that the tuberculous focus persists. Fedoroff describes an atypical form of tuberculosis of the kidney in which there is an inflammatory reaction without tubercle formation.

Recently it has been recognized that the initial infection may occur in the prostate and spread from that point. Keyes, Walker, Koll, Barney, and Crandon are a few who have reported isolated tuberculosis of the prostate. MacKenzie and Seng suggest that massive calcification of the prostate may be due to a calcified tuberculous lesion. Walker was able to find, however, but three acceptable cases in the literature; nevertheless Barney states the scarcity of such cases does not represent a true percentage but a "deplorable failure" on the part of surgeons to make proper examinations. Dillon reports a series of seminal tract tuberculosis and concludes that the initial lesion of such disease is more often in the pelvic glands than is generally conceded. Nitch considers that the infection of the epididymis is most frequently secondary to an infection in the seminal tract or prostate because the oldest lesion is located in the globus minor and extends from there toward the testis. Primary deposits in the globus major, he states, are rare and perhaps always hæmatogenous.

Other clinical and pathological variations are not clearly defined or sufficiently systematized to be of use in applying therapeutic measures. For example, the question of ascending kidney infection is little understood, as is also the relation of hydronephrosis to renal tuberculosis. Regarding the former, most authors consider that the ascending type of infection occurs occasionally but is not the rule. Hammond thinks that the second kidney is affected by ascending infection. Buerger, Oraison, and Boeckel and Oberling report cases appearing to be ascending infections. Greifenstein and Kehl state that ascending infection occurs only in advanced tuberculosis of the bladder.

Hydronephrosis appears to be present in certain types of kidney tuberculosis. It is probably due to a ureteral stricture from a tuberculous process or associated infection. Cumming has made a study of these concomitant conditions and divides the cases into four groups; first, unilateral involvement having hydronephrosis and tuberculosis; second, unilateral hydronephrosis in one kidney and tuberculosis in the opposite kidney; third, bilateral hydronephrosis and tuberculosis on one kidney; fourth, both conditions bilateral which are obviously hopeless.

Perhaps the most important is the rôle of prostatic involvement in genito-urinary tuberculosis. As mentioned above, authors are beginning to recognize its importance; but the relationship to the primary body lesion is not sufficiently understood. Neither do we know much of the relationship to kidney, bladder, ureteral and genital tuberculosis.

There is a definite trend recently to conservatism in the treatment of tuberculosis of the genito-urinary apparatus. In spite of the favorable report of Runeberg who states that fully 80 per cent of the nephrotomized cases were restored to health, Young, Barney, Greifenstein and Kehl, and others are more pessimistic. The proper follow-up study finds that the majority ultimately succumb to their tuberculosis. It is probable that there are many nephrectomies in bilateral disease or in disease of other portions of the genito-urinary tract. Perhaps the absolute unilateral disease of the kidney or epididymis is not so common as thought or the diagnosis is made too late to forestall a spread to other parts of the genito-urinary tract after operation.

In the subsequent report, we shall cite cases and chart the results of autopsy findings in a series of tuberculous individuals and from these draw what conclusions we may. In doing this we are aware that such data must be interpreted continuously, and conclusions which are drawn from the autopsies must apply only to patients dying of pulmonary tuberculosis, few of whom were other than cases of pulmonary tuberculosis from the beginning.

In this study, we have included 103 pairs of kidneys in male patients; 70 bladders; 50 lower genital organs of the male; 71 pairs of kidneys of the female and 64 bladders, tubes, and ovaries. The discrepancies in the figures are due to the fact that proper sectioning was not done on certain organs. As it is, the sectioning was done every 5 to 6 millimeters and suspicious specimens were examined microscopically. This method is obviously not as complete as Medlar's, although

TABLE I.—MEN DYING OF ADVANCED PULMONARY TUBERCULOSIS—103 PAIRS OF KIDNEYS

Pathology	Number	Percentage
Generalized miliary (bilateral)	1	1.0
Localized miliary (bilateral)	6	6.2
Hyperplastic (unilateral)	1	1.0
Ulcerative (1 unilateral and 1 bilateral)	2	2.0
Total	10	10.2

TABLE II.—MEN DYING OF ADVANCED PULMONARY TUBERCULOSIS—70 PROSTATES

Pathology	Number	Percentage
Miliary and caseous nodular (2 primary, 3 secondary)	5	7.1
Hyperplastic nodular (primary) (positive also in kidney)	1	1.4
Total	6	8.5
Primary in prostate alone	1	1.4
Primary in prostate, but secondary in vesicles, bladder, and kidney	1	1.4
Primary hyperplastic	1	1.4
Total primary	3	4.2
Secondary in prostate but primary in epididymis, vas, and vesicles	2	2.8
Secondary in prostate but primary in epididymis, vas, and vesicles but also local miliary in kidneys	1	1.4
Total	3	4.2

the only difference will be in the relatively rare organs possessing isolated microscopic tubercles. In this type of tubercle we should expect to obtain a lower result than did Medlar.

In Table I is one case of generalized miliary tuberculosis in which the process was extended to both kidneys. Six other cases had miliary tubercles scattered through both kidneys that was not a part of a generalized tuberculosis but of a localized process. One patient had a unilateral hyperplastic process that is shown in Figure 1. This will be described separately as will the bilateral ulcerative kidney involvement shown in Figure 2.

In Table II are charted various forms of prostatic involvement. This makes a total of 8.5 per cent of all male cases posted. The hyperplastic nodular is the same case as shown in Figure 1. The primary tuberculosis in the prostate alone was an isolated nodular tubercle found in a terminal case of pulmonary tuberculosis. The other primary cases shown in Figures 2 and 3 will be given in the case summaries.

Secondary involvement of the prostate perhaps occurs in all advanced disease of other parts of the genito-urinary tract.

TABLE III.—MEN DYING OF ADVANCED PULMONARY TUBERCULOSIS—50 EPIDIDYMIDES, VASA, VESICLES

Pathology	Number	Percentage
Primary caseous	4	8.0
Secondary, primary in prostate	1	2.0
Secondary in vesicles, primary in prostate	1	2.0
Total	6	12.0

TABLE IV.—MEN DYING OF ADVANCED PULMONARY TUBERCULOSIS—70 BLADDERS

Pathology	Number	Percentage
Ulcerative (all secondary)	3	4.3

In Table III are charted the findings in the epididymis, vas, and vesicles. In the epididymis we believe exists one of the most common sites of infection of the genito-urinary tract, yet it may not be as exclusive here as is commonly thought.

The bladders shown in Table IV and in the females appeared to be secondary to involvement of other portions of the genito-urinary tract.

In Table V are the figures on the kidneys from 71 female patients. The kidney involvement is about the same in formation and type as in the male with the exception of miliary abscesses that were found in 5 cases. These, we feel, were very early tubercles that have not developed specific character. Why these should show more in females we cannot answer. The hyperplastic tuberculosis was in a colored woman having a disseminated nodular tuberculosis throughout (tuberculomata).

In Table VI besides the bladders, already mentioned, are the findings of the other female genital organs. Up to the present time we have had only one typical case of tuberculous endometritis. This is not included in the table but has been a recent finding. Table VI shows only one case having a slight involvement of the endometrium, and another having a superficial miliary process on the peritoneal surface as the part of a generalized process.

CASE REPORTS

CASE 1. A unilateral hyperplastic process in a white American having a disseminated large nodular tuberculosis (tuberculomata) in all the organs. The kidney and prostate are shown in Figure 1. The characteristic picture microscopically is a diffuse epithelioid and fibrous infiltration with many granules and cocci present.

CASE 2. C. P., No. 24732. The essential points of the history are that at the age of 12 years, patient stated that he fell injuring his scrotum and penis. Five years later hæmaturia occurred lasting only half a day. The following year hæmaturia occurred again. Since then it has occurred about four times at irregular intervals. Last time was 2

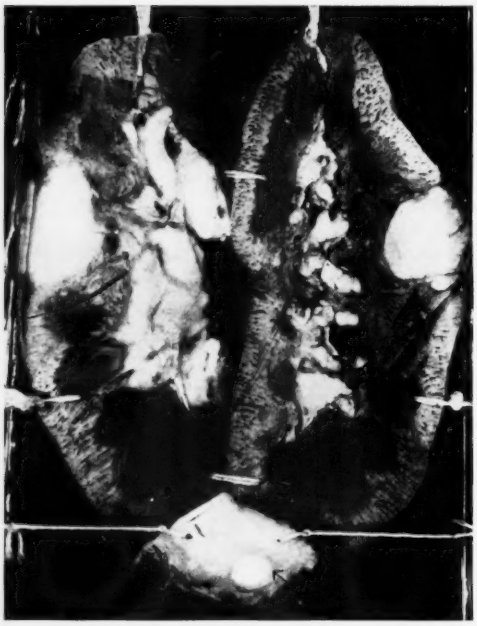

Fig. 1. Hyperplastic or large nodular type of tuberculosis of one kidney and the prostate, *b*.

days ago and was not accompanied by any pain. Patient had mumps 6 years ago followed by orchitis lasting 3 weeks. He had had the other usual childhood diseases. Venereal disease was denied.

The autopsy revealed a completely atrophic right testicle, epididymis, and vas deferens. There was caseous tuberculosis of the right seminal vesicle and the right side of the prostate. There was a non-specific abscess in the prostate with marked hyperæmia; there was a diffuse tuberculous involvement of the bladder causing coarse trabeculations with several miliary tuberculous nodules in the mucous membrane. The left kidney contained several large tuberculous ulcers in the calyces but not in the parenchyma of the kidney. There was a markedly hypertrophic dilated ureter. The right kidney also had a dilated ureter. There was a moderate hydronephrosis present in the right kidney. An early inflammation of the pelvis was also present.

Microscopically there were found very few patent tubules in the right testicle and epididymis. The majority were completely hyalinized. There was no tuberculosis. The right vas deferens was normal. The right seminal vesicle was caseous. The right side of the prostate was caseous with a few giant cells. There was a completely calcified tubercle present. A diffuse acute abscess was found in the left side of the prostate. The left testicle, vas, and epididymis were normal. The left ureter was markedly dilated. This ureter and kidney were infiltrated with many polymorphonuclears and lymphocytes. No giant cells could be found. The pelvis of the kidney was destroyed in the abscessed portion and there was marked infiltration of the medulla by polymorphonuclears and lymphocytes. No giant cells were present. The right

TABLE V.—WOMEN DYING OF ADVANCED PULMONARY TUBERCULOSIS—71 KIDNEYS

Pathology	Number	Percentage
Generalized miliary (bilateral)	1	1.4
The terminal disease began from a ruptured nodular pyramidal tubercle that spread fan shaped to capsule and into peritoneal cavity.		
Localized miliary, (bilateral)	4	6.0
Hyperplastic tuberculosis	1	1.4
Total	6	8.8
Miliary abscesses (possibly tuberculous)	5	7.0

TABLE VI.—WOMEN DYING OF ADVANCED PULMONARY TUBERCULOSIS

Bladder Pathology	Number	Percentage
Ulcerative	2	3.0
Uterus, tubes ovaries	64	
Generalized miliary (primary in kidney)	1	1.05
Localized on serosa of peritoneum	1	1.05

kidney revealed a slight infiltration of the pelvis but no destruction of the epithelium. The reasons for assuming that there was a primary prostatic infection are as follows: (1) There was a history of trauma followed by suspicious symptoms in the prostate region. (2) There was the oldest appearing gross lesion in the prostate. (3) There was a calcified tubercle in the prostate around which were caseated foci and giant cells, the only giant cells present in the whole genito-urinary system. (4) The kidney infections were recent—left, definitely tuberculous extending from the pelvis into the medulla; the right showing only early hydronephrosis and inflammatory changes not characteristic of tuberculosis. (5) There was no tuberculosis below the vesicles.

A most important feature of this case is the fact that the pulmonary involvement seemed to be a very recent development without any calcified lesions. It is going too far, at present, to claim that tuberculosis was primary in the prostate. The primary lesion may have been in the lung with very slight involvement and the secondary lesion occurred in the prostate, then the terminal disease occurred in the lung. This case is being studied more exhaustively.

CASE 3. April 8, 1925. A patient, Mrs. W., reported at the hospital at the suggestion of her physician for a dilatation of the left ureter. This patient had been dilated before and a complete physical examination made, including a bacteriological study of the urine and an injection of guinea pigs, all of which were negative for tubercle bacilli. It may be added that the patient came to the hospital because she was suffering with pain on the left side, in the lower quadrant and had been relieved before by dilatation. The ureter was dilated and she secured relief of pain. Her relief continued until July 17, at which time she suffered an acute hæmaturia from the urinary bladder. She was suffering with excruciating pain on the left side and passing large quantities of blood. She was immediately taken to the hospital and everything done including a blood transfusion to stop the hæmorrhage. A

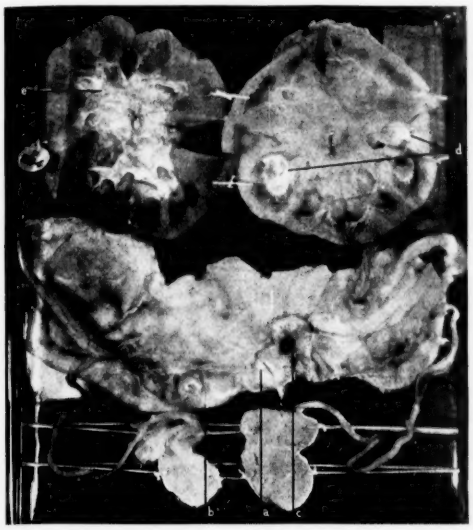

Fig. 2. Primary genito-urinary tract tuberculosis of the prostate. Looking from the posterior part of the bladder. *a*, Tuberculous prostate, right side. *b*, Tuberculous seminal vesicle (right). *c*, Non-specific abscess in prostate. *d*, Ulcerative tuberculous lesion in left kidney. *e*, Slight hydronephrosis in right kidney.

cystoscopy was made with an irrigating cystoscope and it was possible to see that blood was coming from the left ureter. The hæmorrhage stopped temporarily but started after a few hours. The hæmorrhage was controlled fairly well for the first 24 hours, once by leaving a catheter in the ureter for 2½ hours. The urine was collected from both sides. The left side showed many tubercle bacilli while the right was straw colored and normal in appearance, and negative for tubercle bacilli.

Inasmuch as we were unable to control the hæmorrhage and inasmuch as the other side was free from tubercle bacilli, there was no other choice than to do a nephrectomy on the left side. She was taken to the operating room, and the kidney was quickly removed under nitrous oxide gas anæsthesia. The patient was again transfused but had a stormy convalescence.

Pathology: The kidney showed two tuberculous lesions in the superior pole, one had broken into the upper calyces while the other lesion was about 0.5 centimeter away from the pelvis of the kidney.

This patient never did make a complete recovery. Although her hæmorrhage was completely controlled, she developed meningitis and died October 12, 1925. The important point in this case is the fact that she developed a hæmaturia on the opposite side, 10 days before her death, and on ureteral catheterization, showed many tubercle bacilli by direct smear on examination.

It seems to us that this case makes a very good illustration of what we have to contend with in making a diagnosis of unilateral renal tuberculosis. Here we were dealing with a patient who had been handled by an excellent urologist. He

Fig. 3. Primary genito-urinary tract tuberculosis of right epididymis, vas, and vesicles with ulcer in bladder at *a*.

had made all tests possible for renal tuberculosis, including guinea pig inoculations and, as stated above, they were all negative. It was found that she had a tuberculous left kidney, and while there was no question as to the choice of treatment, a nephrectomy was done, but the same condition soon made its appearance in the other kidney. This case reveals clearly the necessity for a close study of the opposite, so-called "normal" kidney. This case confirms very well the work done by Braasch and others in which he found many patients who were found to have a tuberculous lesion on the opposite side after one kidney had been removed.

Case 4. Mr. G. entered the Hospital February, 1927. He was 64 years of age and had all the symptoms of a patient suffering with a hypertrophied prostate. On rectal examination the prostate was found large and smooth and presented no nodules whatever. Cystoscopic examination showed the bladder to be normal with a few trabeculations present but otherwise resembling the bladder of a man suffering with an enlarged prostate. A blood chemistry examination was made, and while the non-protein nitrogen was 46 and the rest of the blood chemistry correspondingly the same, and the centrifuged specimen showed the presence of no tubercle bacilli, we decided to try a retention catheter for drainage.

It seems a little easier and better technique to do the operation in one step rather than two steps, provided the patient will tolerate a retained catheter, as this patient did.

Patient was prepared in the usual manner, forced fluids being given. He was operated on on the fourteenth day after entering the hospital. The prostate was easily removed except the most posterior portion which presented some difficulty owing to apparent adhesions. At the time of the operation it seemed that an error might have been made in diagnosis and that the patient was suffering with a malignancy of the prostate which had not been recognized by palpation through the rectum or by cystoscopic examination. Sections were sent to the laboratory and we were greatly surprised to find that the prostate showed tuberculous lesions.

The patient made an uneventful recovery and up to the time of this writing, has shown no untoward results from the operation. No signs of disease were found in the epididymis. The urine was free of tubercle bacilli before and has shown none since the operation. This specimen has the appearance of a primary tuberculous lesion of the prostate. Although clinical and laboratory examinations reveal nothing in any other part of the genito-urinary tract, there is still the remote possibility that a tuberculous lesion may have been present elsewhere.

DEDUCTIONS

The principal features of this study may be stated rather briefly. Most important is the fact that there seems to be a sharp differentiation between the genito-urinary involvement as a terminal process to the pulmonary tuberculosis and the process that manifests itself primarily in the genito-urinary tract. The former is nearly always miliary and bilateral and rarely requires surgical intervention. The hyperplastic types (those associated with a generalized nodular tuberculosis) may be unilateral but are not likely to require surgical treatment, because such a type of tuberculosis is rather progressive at any stage and not easily amenable to any kind of treatment. The other group is the one of most importance from a surgical standpoint. Such lesions must be grouped into surgical and medical but this classification is a difficult clinical problem. No doubt many cases are distinctly surgical but the surgery must be done at an opportune time and the method adapted to the type of disease. On these factors depends the outcome of treatment.

It avails little to remove a kidney and leave a badly infected prostate to affect the opposite side, or to remove an epididymis and leave an infected seminal vesicle. Not infrequently there occurs a tuberculosis, rarely of the prostate. Either of these processes should be diagnosed early and removed by an operation and the operation should be sufficiently radical to eliminate all of the foci of infection, if it is done at all.

The operation on the epididymis should be done before the spread reaches the vesicles, otherwise vasectomy and perhaps prostatectomy should be done. To leave an infected prostate means that the spread will continue to the other side and perhaps to the kidney eventually.

There are also times when one kidney is removed when it has been decided that an opposite kidney is negative, only to find that there is in the supposedly normal kidney an enclosed caseous tubercle that ruptures later. A definitely established advanced unilateral tuberculosis of the kidney must be removed, but it should not be done until a painstaking study of the other side has been made.

We believe that tuberculosis of the prostate is more common than the literature would lead us to believe.

CONCLUSIONS

In a report on the autopsy findings in 174 patients dying of pulmonary tuberculosis, the genito-urinary findings reveal:

1. The kidney is affected in 10.3 per cent of the male and 8.8 per cent of the female patients and the tuberculosis is miliary, bilateral, and inoperable in most of the cases.

2. In some instances only one kidney is involved in the presence of a generalized, disseminated, large nodular, tuberculosis also inoperable.

3. No operable kidney lesions were found in this series of patients dying of pulmonary tuberculosis.

4. Operable tuberculosis of the kidney is more likely to be found in patients having extrapulmonary lesions or in patients with minor foci in the lungs.

5. Primary genito-urinary tract tuberculosis involved the epididymis in 8.0 per cent of cases. This type is operable if operation is done early. The extent of the operation depends on the amount of spread of the disease to the other part of the genito-urinary tract.

6. Primary tuberculosis of the prostate occurred in 4.2 per cent of these patients. The disease is perhaps more common than the reports indicate.

A clinical report is cited of what appeared to be a primary prostatic tuberculosis (referable to the genito-urinary tract). A clinical report is also cited to show the risk entailed in removing a tuberculous kidney with a "negative" opposite kidney.

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RIGHT PARADUODENAL HERNIA[1]

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PARADUODENAL hernia is the term given to hernias about the duodenal jejunal flexure, which come under the classification of intra-abdominal or retroperitoneal hernias. They are rare and have never been diagnosed clinically. They are characterized by the protrusion of abdominal contents through a congenital or anomalous opening wholly within the abdomen.

Paraduodenal hernias are of two types: right and left. Thirty-four of the right and 105 of the left have been recorded in the literature. Of the 34 recorded cases of right paraduodenal hernia, 17 came to operation, the remaining 17 being found at autopsy. Of the 17 operated upon, there were 6 recoveries, and 11 deaths. My case makes the thirty-fifth reported, the eighteenth that came to operation, and the seventh recovery.

The origin of all these intra-abdominal or retroperitoneal hernias is considered to be at various points in the abdominal cavity where rudimentary fossæ are found. Moynihan[2] describes 9 of these fossæ about the duodenal jejunal flexure in which internal hernia may be found. The most important are the superior and inferior paraduodenal folds and the fossæ of Waldeyer and of Landzert.

There are numerous theories concerning the formation of folds and fossæ about the duodenum. Waldeyer considered the elevation of the peritoneum by blood vessels to be an important factor. Toldt explained the fossæ as physiologic adhesions. Other theories are: embryonic origin, as late descent of the cæcum; formation of pockets during intestinal rotation; formation of fusion folds in fetal life; and failure of the root of the mesentery to unite with the posterior abdominal wall. This latter theory was advanced by Moynihan and is accepted by most modern writers.

The fossa of Landzert (Fig. 3) is the space beneath the fold resulting from the union of the thin avascular peritoneal folds forming the superior and inferior paraduodenal fossæ. This fold contains, about 5 millimeters from its free edge, the inferior mesenteric vein and a branch of the left colic artery. The orifice of this fossa looks to the right, and herniation into it progresses upward, outward, to the left, and retroperitoneally. This represents a left paraduodenal hernia and is by far the most common type.

Moynihan describes the fossa of Waldeyer as lying in the first part of the mesojejunum, bounded in front by the superior mesenteric artery, and behind by the lumbar vertebræ. The fossa so formed lies to the right of the body and its orifice opens toward the left. The peritoneum of the left leaf of the mesentery lines the fossa; that of the right covers the blind end and is then continued directly into the posterior parietal peritoneum. A forcible enlargement of the fossa would then result in a tearing-up of the layer of peritoneum lining the posterior abdominal wall.

The most common folds and fossæ are the superior and inferior paraduodenals. These folds are composed of thin, non-vascular peritoneal membranes passing laterally from the bowel to the posterior abdominal wall (Fig. 3).

In considering the origin of the right paraduodenal hernias, Nagel of the Mayo Clinic states: "It has not been definitely established since it has not been observed in the early and progressive stages, but that nearly all observers agree that the condition represents a true herniation of the intestines into the one or the other of the fossæ about the duodenojejunal flexure; that a knowledge of the embryology and anatomy of these fossæ is essential to the proper understanding of these types of hernia; and that the entire subject has been needlessly complicated and confused by different names attached by various investigators to identical structures, this nomenclature being no doubt due to the wide normal variations in size, shape, and minor anatomical details of the peritoneal folds in this region."

Nagel, Masson, and McIndoe consider a lower inferior paraduodenal fossa to be the site of origin of some right paraduodenal hernias, but do not deny the possibility of right paraduodenal hernia occurring into the fossa of Waldeyer, which Moynihan considers is always responsible for the development of this type of hernia.

Moynihan lays down the following conditions as invariably present in right paraduodenal hernia:

1. The sac occupies, at first at any rate, the right half of the abdominal cavity, lying behind the ascending and transverse mesocolon.
2. The orifice is situated behind and to the left of the sac on the lumbar vertebra.
3. In the anterior margin of the sac there lies either the superior mesenteric artery or a continuation of it—the ileocolic artery.

[2]Arres and Gale Lectures, 1907.

[1]Read before the Wayne County Medical Society, Detroit, Michigan, January 10, 1928.

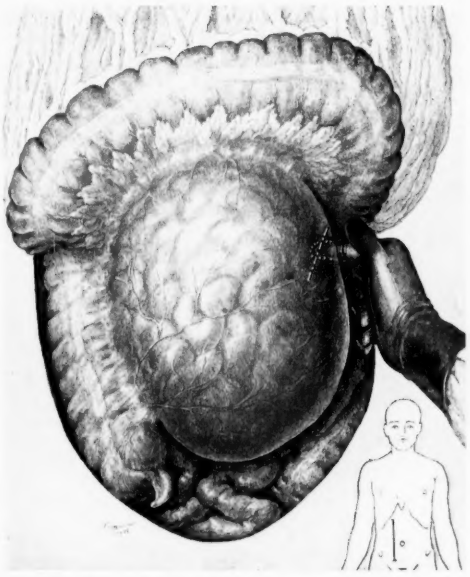

Fig. 1. Right paraduodenal hernia, resulting in a large mass occupying the greater part of the abdominal cavity. The mass, consisting of most of the small intestines and mesentery, is covered by posterior parietal peritoneum which has been stripped up and lifted forward. The forefinger of the right hand is seen entering the hernial opening, rather high up and posteriorly on the left aspect of the mass. The finger was easily visible through the transparent peritoneum. The drawing is semidiagrammatic in that the intestines were not visible, as in the drawing, through the peritoneum covering them. To the lower right hand corner is seen the relative size and position of the abdominal incision.

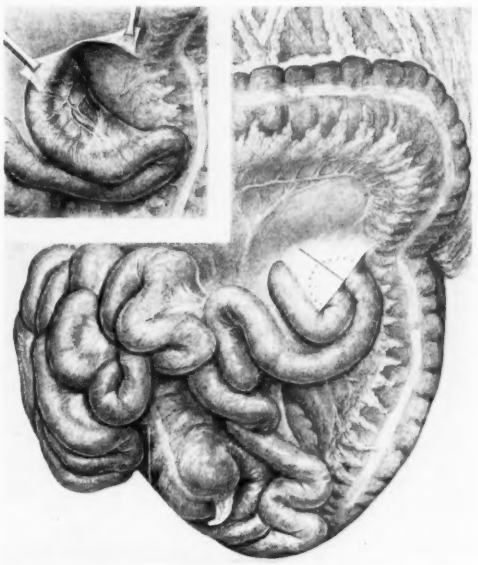

Fig. 2. The hernia reduced up to the jejunum, a loop of which still remains under the fascia-like membrane which extended from the left surface of the first 3 or 4 inches of jejunum to the left side of the base of the transverse mesocolon. This membrane pulled the jejunum to the left and fixed it to the posterior parietal wall. The lower edge of the membrane was very firm and formed a rigid neck of the hernial aperture. In the upper left corner is shown the conditions resulting from the division of the adventitious membrane. The first few inches of the jejunum actually flapped to the right, and the left aspect of the mesentery of it, and the portion of the posterior abdominal wall with which it was in contact, were devoid of peritoneum, this latter combination of factors resulting in a congenital aperture which accounted for the origin of the hernia.

Broesike emphasized a fusion of the first part of the jejunum to the posterior abdominal wall which he found in two of his subjects and which he believed to be essential for this type of hernia. This condition has also been observed by others. Moynihan makes this the basis for a division of right paraduodenal hernias into two types, calling those in which the jejunum is adherent "hernia mesenterico-parietalis parajejunalis," and those in which it is free, "hernia mesenterico-parietalis paraduodenalis."

Edmund Andrews calls the term "duodenal hernia" a misnomer and considers the condition a congenital anomaly due to imprisonment of the small intestine beneath the mesentery and the developing colon, and states "the view that these small peritoneal pouches of which there are hundreds scattered throughout the abdomen are the origin of these hernias, is absurd and grotesque." He asks: "How can anyone conceive of a force which would, once begun, practically always continue to act until all the guts had been segregated into a sac, even when the remainder of the belly is empty?" In support of his belief, are the following statements:

1. Differential pressure is utterly lacking within the abdomen so that any *vis a tergo* to account for the formation or growth of such hernias is totally absent.

2. There are hundreds of similar folds and fossæ in the peritoneum, many of which are of greater size and are practically never the site of such hernia.

3. In all but a very small minority of the cases reported, the degree of herniation has been total or subtotal.

4. A case of total hernia in a newborn infant was reported. (Left duodenal hernia of Vogt.)

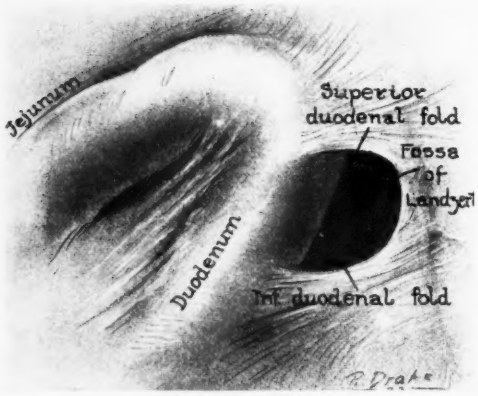

Fig. 3

5. The herniated viscera are never anything but small bowel. The presence of omentum has never been reported.

6. In many cases there has been an almost universal growing-together of contents of the sac.

So far not a single case of right paraduodenal hernia has been diagnosed before operation or necropsy. It may be observed at any age, the youngest patient being that of Paton, age 3 months; the oldest reported by Rose, a woman of 68 years. There were 21 males and 3 females; in 10 cases the sex is not noted.

The great majority were operated upon for symptoms of acute obstruction which may follow several similar attacks or occur suddenly in a previously healthy patient. In the more chronic type, the symptoms have been likened to those of chronic duodenal ulcer, but they resemble rather those of chronic duodenal ileus. In others, there may be more or less severe persistent pain with a little or no vomiting as in chronic obstruction. Lastly, the condition may remain symptomless and be found at necropsy.

The most important physical signs are:

1. Vomiting, which may be scanty or absent, even when obstruction is complete. If continued, the vomitus will consist mainly of bile. There can be no regurgitation of small intestinal contents.

2. Visible peristalsis—a sign of chronic obstruction occurring in the bowel above the site of constriction.

3. Palpable swelling. This is the most important diagnostic sign, when present. It is described by Moynihan as a palpable, definite resident mass which lies at first to the right and lower part of the abdomen, but spreads finally over almost the whole abdominal cavity. On auscultation, distinct gurgling sounds may be heard anywhere over the tumor.

4. Result of X-ray examination. (1) When there is no obstruction, the colon may be shown occupying the left half of the abdomen with the coils of small intestine to the right. (2) When there is chronic obstruction of the afferent loop, the X-ray picture will be similar to that found in chronic duodenal ileus, namely: dilatation of the stomach and duodenum with delay in emptying.

5. Toxæmia and collapse. These vary according to the intensity of the acute obstruction and the amount of small intestine strangulated.

The treatment of this condition should be surgical, operation being undertaken at as early a stage as possible. The mortality is undoubtedly influenced by the same factors that govern intestinal obstruction due to other causes but involving the same segment of the alimentary canal. The presence of important vessels in the neck of the sac (in the case of left paraduodenal hernia—the inferior mesenteric vein, and in the case of right paraduodenal hernia—the superior mesenteric artery) should be constantly borne in mind. Whenever possible, the sac should be ablated or its mouth closed. The postoperative care is similar to that following intestinal obstruction due to other causes.

Following is the report of the author's case of an incarcerated right paraduodenal hernia, causing an acute intestinal obstruction:

J. C., male, aged 24 years, Italian. The family history was irrelevant. The past history was irrelevant, with the exception that about 1 year ago the patient had an attack of severe abdominal pain associated with nausea and vomiting. This attack lasted for several hours, when following an effectual enemata, the pain and distress suddenly abated. There apparently was no aftermath to this attack, as the patient was about on the following day.

Shortly after arising, on the morning of April 19, 1926, the patient was suddenly taken with severe generalized abdominal pain which was soon afterward followed by nausea and vomiting. An enema, given shortly after the onset of the pain, was ineffectual. The pain was most severe in the midabdomen and persisted throughout the day, and the patient vomited repeatedly. The family physician saw him about 10 a.m., and made a diagnosis of "acute abdomen" and ordered the patient's immediate removal to the hospital. However, the patient did not arrive at the hospital until 8 p.m., and during the time that had elapsed between the doctor's visit and his admission to the hospital, there was practically no let-up in the intensity of the pain, but if anything, it grew progressively worse. An enema given at 3 p.m. resulted in the passage of some flatus and a small amount of dark red blood.

Physical examination disclosed a young man, 24 years of age, well developed and well nourished, presenting the appearance of being acutely ill and in severe pain. He was very pallid and wore a pinched, anxious expression. His face was bathed in perspiration. With the exception of the abdomen, the physical examination presented no abnor-

malities. The abdomen was moderately distended throughout. No masses of peristaltic waves were visible. There was generalized tenderness and rigidity throughout which was most marked in the central part of the abdomen. A rather indefinite mass seemed to occupy almost the entire central part of the abdomen, but on account of the rigidity and distention, one could not be positive about this. Auscultation revealed nothing abnormal, such as gurgling, etc.

Temperature at the time of admission and examination was 101.5 degrees F.; pulse, 90; respirations, 18. The white blood cells numbered 24,000; polymorphonuclears, 90 per cent. The urine was normal.

A diagnosis of acute intestinal obstruction was made, either the result of intussusception or volvulus, the diagnosis being based on the presence of a mass in the abdomen, together with the passage of blood during the afternoon.

Operation. The abdomen was opened through a right rectus incision just below the level of the umbilicus. The appendix was found in its normal location but it presented a markedly ischæmic, putty-like appearance. The cæcum was also contracted and ischæmic in appearance. Exploration revealed a large rounded mass occupying the entire center of the abdominal cavity, whereupon the incision was enlarged upward and downward, until it was about 7 inches in length. The incision was spread wide open with retractors, thus disclosing the mass (Fig. 1) which was found to be cystic and very tense throughout and covered with fat-laden peritoneum. Anteriorly, the mass was practically in contact with the parietal peritoneum over a large area. On the right it extended to the ascending colon; above it reached to the transverse mesocolon; on the left it "bulged" well over toward the descending colon; while below it extended almost to the promontory of the sacrum. No coils of small intestine were seen.

The entire large colon was ischæmic and contracted. The ascending colon was pulled to the left and the right kidney was palpated and its outline visualized through the peritoneum to the right of the ascending colon. The nature of the mass and its origin could not be determined for a considerable interval, regardless as to how I approached it, as it was attached to the posterior abdominal parietes over a large area and was quite fixed in position. I felt that I was dealing with a retroperitoneal condition—a pancreatic cyst or a mesenteric cyst being the uppermost diagnoses in my mind. Finally, after many unsuccessful efforts to determine the real nature of the condition and when I was about to open the presenting surface of the mass, my right forefinger entered an opening, which seemed to be 1½ inches or so in diameter, high up on the left aspect of the mass and to the left of, and about on the level with, the second lumbar vertebra (Fig. 1). The outline of my finger was visible through the peritoneum covering the mass. I then realized that I was dealing with a paraduodenal hernia and that the mass was made up of practically all of the small intestines and their mesentery.

The nearest coil of small intestine at the lower half of the hernial opening was then grasped and by pulling down and to the left, the small intestines with their mesentery were easily removed from the sac and restored to their normal position in the abdominal cavity. There were no adhesions between the coils of intestines, and they were markedly contracted throughout. As they were pulled down and out from the sac, there was a marked difference noted in their color, some portions being very dark purplish and mottled, while others were markedly red and injected. When the proximal part of the jejunum was reached, considerable pull was necessary to liberate it, but when liberation was accomplished, it was found that the intestines had been pulled from under a firm fibrous membrane, which extended from the left surface of the jejunum over a length of about 2½ inches, to the left side of the base of the transverse mesocolon (Fig. 2). The lower edge of this membrane was very firm and dense and formed the neck of the hernial sac. This band of tissue was broken up between the thumb and forefinger, with great caution, since I realized that either the superior mesenteric artery or some of its branches, or the inferior mesenteric vein, might be intimately involved in the neck of the sac. It was then seen that the band of tissue had been binding down about the first 3 or 4 inches of jejunum with its mesentery to the posterior abdominal wall and when the band was divided, the jejunum actually flapped to the right as though it had been under considerable tension. The left surface of this portion of the jejunal mesentery was found to be devoid of peritoneum, the jejunal vessels standing out prominently in the mesenteric fat (Fig. 2). Also, the posterior abdominal wall to which the jejunum and its mesentery had been bound down, had no peritoneal covering. In this region there was a small amount of milky fluid which had the appearance of chyle.

The conditions, as now revealed, made it evident that this anomalous opening or aperture in the peritoneal investment of this part of the abdominal cavity allowed the small intestine to progress to the right, retroperitoneally, and under the superior mesenteric artery, stripping up the peritoneum of the posterior abdominal wall as it progressed, once a knuckle of gut had started to invaginate under the hernial ring described, until practically all of the small intestines and mesentery were retroperitoneal and formed the mass. I believed that I had rid the patient of the possibility of a recurrence of the hernia, for I had destroyed the anomalous membrane and hernial ring, so no attempt was made to do anything further; in fact, it did not seem possible to do anything further, and the abdomen was closed in layers without drainage.

The patient made an uneventful recovery; the pulse and temperature were normal within 24 hours after operation. There was no postoperative vomiting, distention, or any other untoward condition. The bowels functioned normally throughout the remaining stay in the hospital. The patient was discharged as cured on Sunday, May 2, 1926, 13 days after operation. The patient has been seen several times a year for the past 4½ years, and there is no evidence of any return of the hernia, nor are there any intestinal symptoms which would make one suspicious of same.

CONCLUSIONS

The case herein reported presents the following unique and interesting features, considering all the divergent views and contentions that exist concerning these paraduodenal hernias:

1. It represents a right paraduodenal hernia the origin of which was very obvious in that there was a congenital anomaly of the normal peritoneal investment of the abdominal cavity in the region of the jejunum; this anomaly consisted of: (1) The left surface of the mesentery of the first 3½ or 4 inches of jejunum and the posterior abdominal wall with which it was in contact, devoid of peritoneum, with a resultant opening or aperture in the normal peritoneal investment which could and did allow the escape to retroperitoneal position of the intestines and their mesentery. (2) A hernial ring which was formed by the lower edge of the firm fibrous band which extended from the

left aspect of the jejunum to the left base of the transverse mesocolon, and once a knuckle of gut had started to invaginate under this ring, peristalsis caused the whole intestine ultimately to assume the retroperitoneal position. (In contrast to these findings, Nagel states that the origin is not definitely established as such hernias have not been observed in the early, progressive stages.)

2. There was present what Broesike emphasizes in the origin of these hernias, and what he found in two of his subjects, namely: fusion of the first part of the jejunum to the posterior abdominal wall and which Moynihan classifies as "hernia mesenterico-parietalis parajejunalis."

3. Whereas Nagel and nearly all observers agree that the condition represents a true herniation of the intestines, this was not so in the author's case, as almost the entire small intestine and mesentery had escaped into a retroperitoneal position through the congenital defect in the peritoneal lining of the abdominal cavity, there being no sac of peritoneum forced ahead of the intestines. The posterior parietal peritoneum in the right half of the abdomen formed a sac for the intestines as a result of having been stripped from the posterior abdominal wall and lifted forward.

4. The lifting-up of the posterior parietal peritoneum resulted in the ascending colon being pulled to the left to the extent that the right kidney was palpable and its outline visible through the peritoneum to the right of it.

5. Whereas Edmund Andrews contends that the term "duodenal hernia," is a misnomer in that differential pressure is utterly lacking within the abdomen so that *vis a tergo* to account for the formation and growth of such hernias is totally absent, in this case such conditions were unnecessary as there was no sac forced ahead of the intestines. Also there were no adhesions or growing-together of the contents of a hernia which he claims were found in many of the reported cases.

6. In one respect it differed from the conditions as laid down by Moynihan which are invariably present in right paraduodenal hernia, in that the superior mesenteric artery was not seen or felt in the anterior margin of the sac before the hernia was reduced. This condition could not be present in this case as the first part of the jejunum was pulled over to the left and fused to the posterior abdominal wall, and in the formation of a hernia, the intestines had to pass under this portion of the jejunum before passing under the superior mesenteric artery and its branches. However, although not seen, the superior mesenteric artery must have occupied a position in the anterior part of the neck of the hernia as the intestines had to pass posteriorly to it to assume the retroperitoneal position which they finally reached.

7. The other two conditions laid down by Moynihan, namely: (1) the hernial sac occupying principally the right half of the abdomen and lying behind the ascending colon, and (2) the orifice situated behind and to the left of the sac and on lumbar vertebra, were present in this case.

8. The cæcum, appendix, and ascending colon were markedly contracted, ischæmic, and putty-like in consistency and color, which must be explained by their blood supply being interfered with, due to the torsion of, and traction on, the root of the superior mesenteric artery and its branches by the rotation posteriorly around it and to the right of practically the entire length of small intestine and mesentery.

The author wishes to express his appreciation and thanks to Dr. E. J. Panzner, of Detroit, Michigan, who kindly referred this case to him.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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FEBRUARY, 1932

THE SELECTION OF GASTRIC ULCERS FOR SURGERY

IN our endeavor to improve the statistics of operations for carcinoma of the stomach, surgical attention has very naturally been directed toward gastric ulcer as a causative or at least a suspiciously associated lesion. There is a very natural and distinct tendency to assume the position that duodenal ulcers with their lack of danger of malignant degeneration may be safely submitted to a trial of non-operative measures, but that all gastric ulcers are at once surgical. This position is assumed because of the danger of overlooking a malignant lesion in an ulcer, because of the incorrect assumption that they are less readily healable than are duodenal ulcers, and because of the assumption that they are forerunners of malignancy.

Dr. Sara M. Jordan has instituted a diagnostic policy which has proved of great satisfaction in this clinic, to the surgeons and gastro-enterologists alike, in helping to distinguish those borderline gastric lesions immediately requiring surgery from those which may be treated by non-operative measures without fear of the development of malignancy.

For a period of one to two weeks the patient is kept under observation in the hospital. During this time he is given most accurate and painstaking Sippy neutralization treatment. The procedure is carried out only in those patients in whom the question arises as to whether or not the lesion is a chronic gastric ulcer, an early carcinoma, or a gastric ulcer with associated malignancy. As long as the frequent fluoroscopic examinations show that the defect in the gastric outline progressively improves, and as long as the symptoms improve and occult blood disappears from the stools, no operative procedure is advised. If the defect in the X-ray picture completely and persistently disappears with the result that the part at which the lesion was present becomes soft and flexible, and the peristaltic waves therefore readily pass through this area—and this can be accomplished in a great many of the cases—surgery is not advised.

If the defect as demonstrated with the X-ray cannot be made to improve, if it cannot be made to disappear completely, even if but a small dimple persists after almost complete disappearance, surgery is advised. This is especially true if symptoms persist and occult blood continues to be present, and even when these two latter criteria are not present and the defect has only incompletely disappeared, it is advisable to operate, since the lesion is then obviously either frankly malignant or a non-healable ulcer.

The plan thus briefly outlined has been employed in this clinic in ninety-six cases of

gastric ulcer suspected of malignancy and has been found to be of real value. For a plan which removes all gastric ulcers in order to eliminate those in which carcinoma may occur (certainly not over ten per cent), the method substitutes a scheme whereby one may segregate borderline gastric lesions into those which are at once justifiably surgical and those which are justifiably and with reasonable safety non-operative. The procedure eliminates exploration for the borderline chronic gastric ulcer suspected of malignancy, which does not possess obvious and visual evidences of malignancy at this state. Exploration results only in resection. Once the abdomen is open, who has the courage to close it and say that there is no malignancy in a chronic calloused gastric ulcer, even when there are no obvious metastatic glands or definite peritoneal plaques?

This plan has rendered us much mental comfort. Our conscience has never been quite clear in doing such a serious operation as partial gastrectomy for all gastric ulcers in order to be rid of the dangerous few, but when after this plan of selection one undertakes partial gastrectomy with its certain risks, one's conscience may be clear for he feels that his advice is justifiable. FRANK H. LAHEY.

SURGICAL CONSCIENCE

SURGICAL conscience is the measure of a complete service to the patient and is the result of humanizing all the aids available through scientific procedure. It contributes intuition and courage in forming judgment, for it should be remembered that a duty still remains after the judicious application of every diagnostic and therapeutic measure offered by modern scientific surgery. Complete as case records may be, a mature surgeon at times cannot make a correct diagnosis from a review of the records unless he also makes a clinical examination of the patient. Years ago surgical judgment lacked sadly the basic principles afforded by complete pathological findings. Today, however, it might be said that these two factors have become reversed in importance because of the overemphasis of the value of laboratory findings. It requires a surgical conscience to be able to make the diagnosis of a "surgical condition," without waiting for a prolonged clinical study which might make an accurate pathological diagnosis possible but would seriously interfere with the patient's chances for recovery.

The term "surgical condition" seems to be a more rational nomenclature than the words "exploratory operation." For instance in the presence of acute abdominal conditions, we have found that, in 384 cases in which operation was done within the first 24 hours with no mortality, the errors in pathological diagnosis were ten times those which were made when operation was delayed 48 hours and the mortality was considerable, even though the errors in making the diagnosis of "surgical condition" were practically nil. The master French surgeon Faure in a recent address in "Science and Conscience in Surgery" says: "But we know also that it is a serious thing to do nothing and that a too comfortable conservatism is very often more dangerous than the thing which the weak and powerless call boldness." When the surgeon condones a negative mistake his conscience should be revived, for surgical courage is not incompatible with surgical conscience which is so often called upon to make a choice between unavoidable evils. At times it is necessary that the surgeon ask himself what he would wish done were he in the patient's place.

Giving patients what they want in a doubtful case, under the guise of correct medical procedure violates conscience.

In this age of economic stress, the surgical conscience is being put to the test of reckoning with phases of surgical activities which heretofore have been ignored. Today physicians in general must revise certain economic policies; for instance, they must endeavor to reduce overhead expenses and to attain a more equitable adjustment of charges while at the same time they must maintain scientific efficiency—all of which works toward an indirect benefit to the patient. With better business methods the surgeon with a good conscience will maintain an equitable income and a satisfied clientele if he reduces the number of those undeserving delinquents who are not entitled to charity, for he will thus save the necessity of overcharging the well to do—a procedure which has invited unpleasant criticism of the profession as a whole. The percentage of the wealthy in the clientele of the average surgeon is becoming smaller and smaller. Economic policies in every line require readjustment. Conscience should lend a sympathetic ear to the great self respecting middle class, for now as never before do they dread the expense of illness more than the ordeal of surgery and will even hazard health and life rather than incur a debt that cannot be paid. A popular author in his "Prayer of the Physician" says: "Give me money; not so little that I cannot have the leisure I need to qualify into my service; not so much that I shall grow fat in head and leaden in heart and sell my sense of ministry for the flesh pots of indulgence."

R. M. HARBIN

MASTER SURGEONS OF AMERICA

WILLIAM HENRY CARMALT

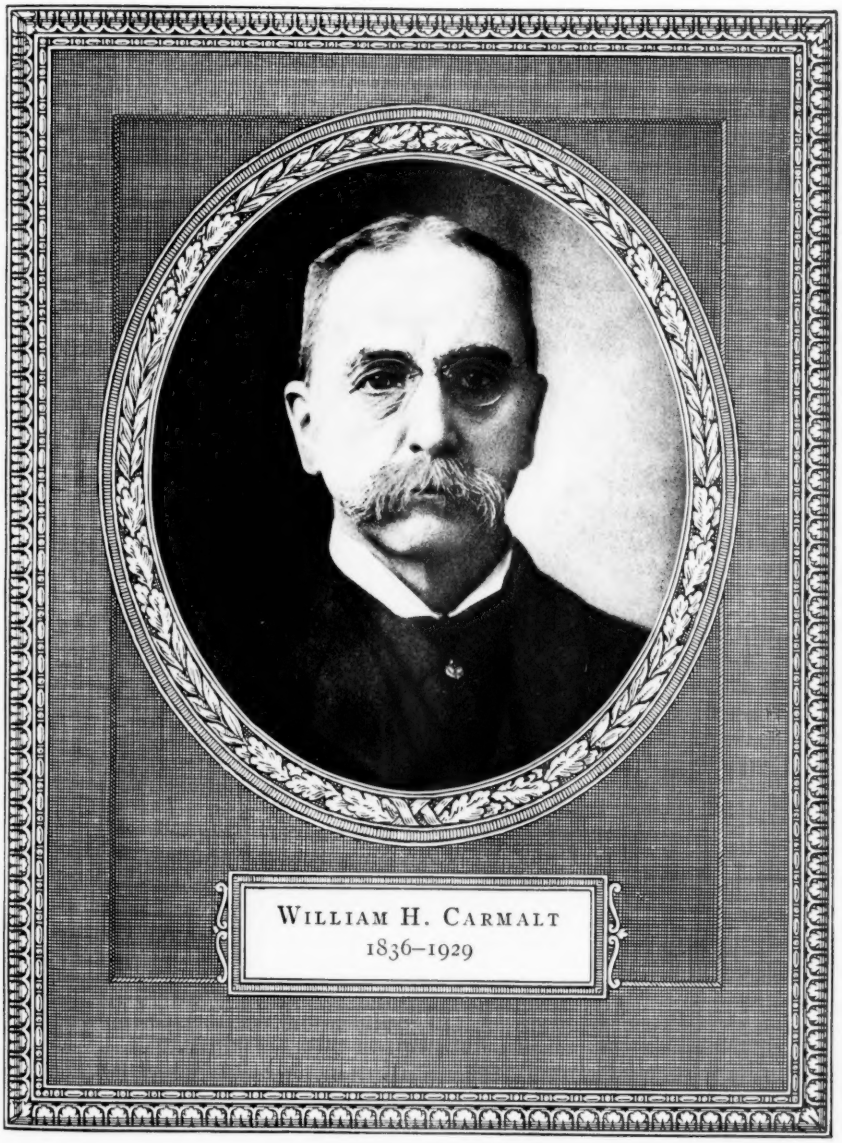
ON July 17, 1929, William H. Carmalt died, a few weeks short of the age of 94 years. He was born of Quaker parentage in Friendsville, Pennsylvania, on August 3, 1836, and his lifetime spanned the introduction of anæsthesia, the orientation of surgery around pathology, the discovery of antisepsis, the development of asepsis, the growth of the entire field of modern surgery, and the establishment of medical teaching under university auspices.

Brought up on a farm he pursued his elementary education at boarding schools and did not fix upon medicine as his profession until he was 21 years of age. He then studied for 2 years with the Doctors Wyman at Cambridge, transferring at the end to the College of Physicians and Surgeons in New York City from which he graduated with the class of 1861. It was at this time that he came under the inspiration and guidance of Dr. John C. Dalton, the eminent professor of physiology there, an association that undoubtedly influenced greatly his subsequent career. This period of training was completed by an interneship at St. Luke's Hospital, following which he engaged in general practice in New York City until 1869, serving for a time with the Union forces in the Civil War.

His bent was very definitely toward ophthalmology, and during the latter portion of this period he was surgeon to the New York Eye Dispensary and ophthalmic surgeon to the Charity Hospital on Blackwell's Island. In 1864 he became a charter member of both the New York and the American Ophthalmological Societies. That this early specialization did not narrow his field of vision is shown by his subsequent career; in fact at the same period, he was acting as a Commissioner of the New York State Agricultural Society and studying infectious abortion in cows, concerning which he drew up an authoritative report.

Not content with these auspicious beginnings and searching for a more thorough preparation for his undertaking of medicine, he gave over his practice in 1870 and went to Germany where he studied for some 4 years under Stricker and Waldeyer going with the latter to Strasbourg at close of the Franco-Prussian War. He acquired a thorough understanding of pathology and a knowledge of the Germanic medical literature which served as a background for his teaching and practice.

In 1876 he opened an office in New Haven, again as an ophthalmologist and 3 years later was made professor of ophthalmology and otology in the Yale Medical School. In 1881 the chair of surgery having become vacant, he was transferred from the special into the larger field which he was to adorn for over 25 years. Like Sands his advancing years found him constantly broadening his activities rather than undergoing the customary shrinkage of interests.



WILLIAM H. CARMALT
1836–1929

Shortly Dr. Carmalt began to publish case reports which today are of value as indicating how closely he trod upon the heels of every advance in his field. Operations under the carbolic spray, asepsis, intestinal anastomosis, appendicitis, the treatment of peritonitis, the use of the roentgen-ray, early interference in gall-bladder disease; one can follow the evolution of surgery as it is portrayed in these. More formal contributions were not lacking however, the most characteristic of these being upon controversial subjects where the public and professional good required that some one of competence speak forth unreservedly. The case then was thoroughly prepared, the evidence assembled, the deductions clearly drawn, and the conclusions so stated that there could be no misunderstanding.

To his teaching he devoted much labor, not only in presenting his own experience but in assembling the literature pertinent to the question in hand. But of greater influence than his didactic presentation was the force of his personality as displayed in the handling of his patients. Honesty of thought, conscientious care, and intolerance of anything that smacked of cheap sentimentality or slipshodness held his students to a rigorous standard. Important as was this influence on the men coming in contact with him, much more so for his profession was his clear thinking and vision as regards medical education. From the first he foresaw and attempted to expedite the conjunction of the medical school and hospital as an educational enterprise, and although in his own consulship he was not to enjoy at first hand the consummation of his desires, he continued to support to the end of his activities the progressive plans of those coming after him.

The interest of Dr. Carmalt in his patients, in the students, and in the medical school by no means exhausted his sense of responsibility. The successive calls to positions of importance within the medical profession, the presidencies of the local city, county, and state medical societies, the last of which he was counselor for many years, the presidency of the American Surgical Association, the positions of responsibility in the Congress of American Physicians and Surgeons, ending in over 20 years of service as chairman of the executive committee; these with many more minor positions were regarded by him as not purely honorary but as carrying with them obligations which he met most conscientiously.

By these many contacts, he became known as a rugged, fearless character with standards of professional conduct not alone for others but for himself as well. Usually gruff but even brutal where occasion demanded it, he neither tolerated "bunk" nor compromised in matters of ethics, yet achieved not only the respect of his profession but the affection of those intimate with him. He exemplified in himself the best qualities of the surgeon who knows the obligations of his profession in the broadest sense and fulfills them.

"*Integer vitae sclerisque purus . . .*"

SAMUEL C. HARVEY.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

A RATHER complete monograph[1] has been written by Davidoff on the pathology, symptomatology, diagnosis, and prognosis of brain tumors. The book is republished from installments which appeared in the *Psychiatric Quarterly*. The author has exhaustively treated the subject of their pathology, emphasizing the importance of the type of tumor for purposes of therapy and prognosis. The classification of the gliomata after that of Cushing and Bailey has been particularly stressed.

The section dealing with the symptomatology of these tumors has been well conceived. He clearly and concisely deals with the common symptoms caused by intracranial tumors in general and then considers the focal symptoms depending upon the anatomical position of the growth and the functional pathways involved. The use of X-rays and ventricular studies as aids to diagnosis are briefly considered. The methods of arriving at a morphological diagnosis from the clinical data are mentioned. The value of such a diagnosis and its influence on the prognosis and therapy is considered of great importance.

The author draws from all that is best in the recent literature of his field as well as from a fair amount of personal material. He appends a large bibliography covering the whole subject.

HALE HAVEN.

THE second edition of the well known French textbook on gynecology[2], by Cotte, differs from the previous edition only through the attempt of the author to keep it abreast of the times. The author has followed the same outline in treating the functional disorders of the female apparatus based on anatomicoclinical facts, physiological principles, and medical and surgical therapeutic results. The subject presented is an accumulation of personal experiences joined to the proved data of the gynecological literature.

In this book the subject matter is systematically arranged and treated with a clarity that is characteristic of most French writings. There is an impartial presentation of unsettled biological data with a sober analysis of the facts presented.

The chapters are well outlined and the illustrations are well executed. Much attention is devoted to dysmenorrhœa and pelvic neuralgia. American gynecologists do not attribute this condition to lesions of the hypogastric plexus, although Dr. Cotte proves that in most cases there are pathological changes in the hypogastric nerves.

SYDNEY S. SCHOCHET and JULIUS E. LACKNER.

THE object of Hertzler's book entitled *Surgical Pathology of Diseases of Bone*[3], is to serve the man doing practical surgery rather than the specialist. The author's material comes under three headings: pathogenesis, pathology, and history. The subject matter is divided into two parts: Part I consists of classification of diseases of bone—acute inflammations, osteomyelitis in special regions, chronic inflammations, diseases due to specific infections, and diseases of unknown origin. Part II discusses bone tumors, classifications of tumors, most important types of tumors, Ewing's tumor and metastatic tumors. Historical discussions and controversial arguments are avoided; the author realizes that primarily the student desires facts and not the means of arriving at them.

The manuscript is readable and easily understood. The illustrations are well chosen, very instructive and clearly reproduced. They include photographs, diagrams, roentgenograms, and gross and microscopic specimens. Those of bone tumors are well done. The book contains a short but well chosen bibliography which the author says is the badge of learning of a medical publication. The references are chiefly to the English literature, but he recommends the cumulative index to those who wish to pursue further reading. As a little by-play, he says that it is stated that there are 12 men in the world who understand the Einstein theory—and he believes that there are not 12 men who understand bone tumors perfectly.

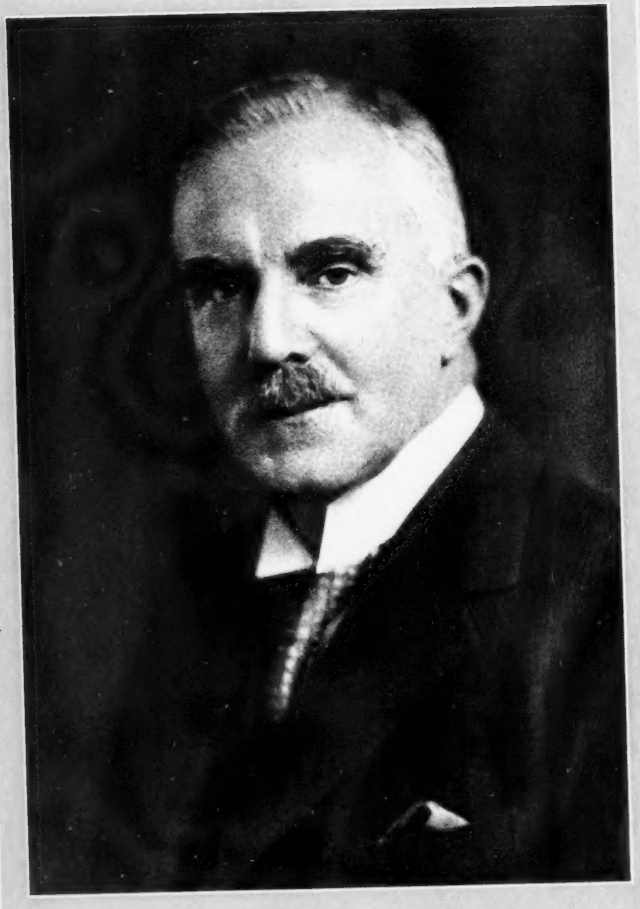
The publisher's work is excellent. The book is handy and should be of real value to the general surgeon, orthopædic surgeon, pathologist, and roentgenologist.

PHILIP LEWIN.

[1] BRAIN TUMORS; THEIR PATHOLOGY, SYMPTOMATOLOGY, DIAGNOSIS, AND PROGNOSIS. By Leo M. Davidoff, M.D. Utica, N. Y.: State Hospital Press, 1931.

[2] LES TROUBLES FONCTIONNELS DE L'APPAREIL GENITAL; ÉTUDE PHYSIOLOGIQUE CLINIQUE ET THERAPEUTIQUE. By Gaston Cotte. Paris: Masson et Cie, 1931. 2d ed.

[3] HERTZLER'S MONOGRAPHS ON SURGICAL PATHOLOGY; SURGICAL PATHOLOGY OF DISEASES OF BONE. By Arthur E. Hertzler, M.D. Philadelphia, Montreal, and London: J. B. Lippincott Company, 1931.



Arthur W. Burgess

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MURPHY, AND SOME PRINCIPLES OF URINARY SURGERY[1]

PROFESSOR ARTHUR H. BURGESS, MANCHESTER, ENGLAND

WE are met tonight to commemorate a great man and a great surgeon, one who was recognized throughout the civilized world as the greatest American surgeon of his day, and one whom future generations will undoubtedly place among the greatest surgeons of all time. It seems only fitting, therefore, that at the commencement of each annual clinical congress of the American College of Surgeons, in the foundation of which he took so keen an interest and played so active a part, we should recall in respectful and appreciative remembrance—John Benjamin Murphy.

It was my good fortune to meet Murphy on three occasions, the last immediately before the outbreak of the Great War, when this congress met, for the first time outside America, in London, under his presidency. Well do I recall his commanding presence, his handsome appearance, his tall and erect bearing. Any slight surprise, on first hearing him speak, that Nature had not endowed him also with a proportionately powerful voice became rapidly dissipated in the beauty, the grandeur, and the consistence of his argument, and the obvious sincerity, enthusiasm, and earnestness of the speaker. Murphy undoubtedly possessed in a superlative degree the power of presenting his facts and his deductions therefrom in so orderly, concise, and forceful a manner as to convey the profoundest conviction. None who heard him could for a moment doubt but that he himself was firmly convinced of the truth of all his statements, and that such belief was not born merely of intuition, but was founded upon prolonged observation of his facts and their careful testing by direct experiment. Himself fired with a restless energy, an indomitable enthusiasm, and a resistless sense of logic, he so influenced the members of his audience by his personal magnetism as to sweep them along with him to the inevitable and irresistible conclusion of his argument.

Although as a clinical teacher, Murphy was admittedly the most sought after of his time, the number of those privileged to have heard his spoken word is steadily diminishing and must of necessity dwindle to zero in the course of another generation. It is, therefore, by his published writings that posterity will judge him, nor need its verdict be feared. The volumes of his *Surgical Clinics*, published bimonthly from 1912 until his death, reveal his innermost thoughts upon the most varied topics of surgical interest, and many truths are there presented in the form of aphorisms so peculiarly appropriate as to command remembrance. Besides articles in textbooks and yearbooks of general surgery, Murphy published 66 papers in the medical and surgical journals, all of them substantial additions to surgical knowledge, and many of them of epoch making importance; practically everything he originated has become standard

[1]The John B. Murphy Oration in Surgery, presented before the Clinical Congress of the American College of Surgeons, New York, October 12–16, 1931.

practice today. In this era of increasing specialism it seems almost incredible that, within such recent times, any single individual could have written with such intense originality and authority upon so many and such diverse branches of the surgical art. As W. J. Mayo so aptly phrases it of Murphy, "We must remember the number of targets at which he shot, and that he always rang the bell." The tendency of the present age is adverse to the development of men of Murphy's type, and it may be confidently asserted that he was the last of that great generation of general surgeons whose genius was sufficient to enable them to grapple successfully with the intricate problems that arise in the entire field of surgical practice.

Murphy's earlier writings were concerned mainly with abdominal surgery, and it was undoubtedly in connection with his "button" for intestinal anastomosis that his name first became prominently known outside America. I doubt whether any other surgical instrument has ever brought to its inventor such immediate and world-wide fame as did his anastomosis button bring to Murphy. The surgical world of that date was just ripe to receive some such appliance. When anastomoses between the hollow abdominal viscera were first attempted, union was effected by a very large number of interrupted sutures; much time and energy were expended in their insertion, and leakage between them not infrequently occurred. Nicholas Senn, by the introduction of his "bone-plates," had eased the situation to some extent, but their correct application was rather difficult, and sutures were still required. Murphy endeavored to devise some means of holding the surfaces of the two viscera to be anastomosed in sufficiently firm contact to ensure speedy and permanent union, to keep the opening between them large enough for their contents to pass freely, and to leave a cicatrix that would not subsequently contract. After many experiments on dogs, he introduced his "button" and provided surgeons with an easier, quicker, and safer method of anastomosis than any hitherto available. This gave a great stimulus to the surgery of the stomach and intestines, and although other mechanical devices were brought forward from time to time, the Murphy button easily held its own. Its supreme value, however, has been as an educational factor—it taught us the essential principles of union between peritoneal-clad surfaces, and proved that all that is really necessary is to maintain them for a few days in close and even contact. Though it is now the almost universal practice to dispense with any form of mechanical device in performing visceral anastomosis, yet it can be truly said that the Murphy button has been the most valuable single educative step in the history of abdominal surgery, and that, without it, the marvelous progress since obtained would not have been possible.

The closely allied conditions of appendicitis and peritonitis early attracted Murphy's attention, and he was a pioneer in his advocacy of their treatment by early operation. In this connection it was that he uttered that most famous of the numerous aphorisms in which his teaching abounds—"Get in quickly, get out quicker,"—a dictum which, if interpreted in the strict sense that Murphy intended, correctly and tersely indicates the two most essential points in the operative treatment. In concluding his masterly paper on "Perforative Peritonitis,"[1] Murphy stated: "We believe that the results of the future can and will be uniformly good. This estimate involves the assumption that the medical profession will make early diagnosis, will insist upon early surgical intervention, will limit its surgical procedures to the least possible handling and trauma consistent with closure of the opening and relief of pus tension, will limit the duration of anæsthesia and quantity of anæsthetic, will shorten the actual time of operation, will insure the continued absence of pus tension, will eliminate the sepsis already in the blood, restore the blood pressure, and will inhibit septic absorption by position." I cannot conceive that the essential feature in the treatment of peritonitis could ever be stated more concisely or more accurately, and although these words were written almost a quarter of a century ago nothing of importance requires to be added to them today. They still represent the truth, the whole truth, and

[1] Surg., Gynec. & Obst., 1908, June.

nothing but the truth, in the treatment of acute peritoneal infections—a truth, moreover, which amounts to an almost complete reversal of all that was previously considered orthodox. Of all Murphy's contributions to surgical progress, this recognition of the defensive and protective capabilities of the peritoneum and the principles by which these can be aided and not hampered in their beneficent efforts constitutes, in my opinion, his supreme achievement. Only those of us who, by length of experience, are able to contrast the results of surgery in peritonitis prior to Murphy's epochal work with those now being obtained can realize what an enormous number of lives he has already been the means of saving, and what an immeasurable load of human suffering he has already prevented.

Of Murphy's other contributions to abdominal surgery, mention must be made of the "Murphy-drip" method of introducing large quantities of saline solution by continuous rectal infusion—a method that has made his name a household word in every hospital—of his monumental production upon ileus, of his pioneer work in the treatment of gunshot wounds of the intestine, of his original procedures in the surgery of the stomach and gall bladder, and of his researches into tuberculous peritonitis. In other surgical fields, Murphy was the first to perform successfully end-to-end suture of an artery in the human being and one of the first to remove an embolus from a large artery; he was a pioneer in the treatment of pulmonary tuberculosis by the introduction of nitrogen gas into the pleural space; and his exhaustive contribution on neurological surgery[1] was certainly the most complete, careful, and concise summary of the subject that had been written up to that time. His later writings were concerned mainly with the surgery of the bones and joints, and his pioneer work in the transplantation of bone, in the prevention of ankylosis following arthritis, and in the restoration by arthroplasty, of movement in ankylosed joints, is admittedly of the most outstanding merit. Murphy's interest was not confined, however, to the purely scientific aspects of surgical work, and many of his addresses concern both the medical profession and the lay public. He emphatically denounced all fads and all forms of quackery, whether within the profession or without; he strongly supported all measures to promote the public health; he stoutly defended experimental research in medicine; and he was a powerful advocate of the systematic instruction of the public in medical affairs by means of inspired articles in the lay press, and by popular addresses and cinema demonstrations during the sessions of medical congresses.

To a remarkable extent, Murphy possessed the ability to sift rapidly the essential from the non-essential and to establish broad basic principles; ever did he emphasize the practical application of the fundamental principles of surgery to the daily work of the surgeon. My predecessors in this oration have shown how he applied these principles in certain selected spheres of his surgical activities, but only scant reference has yet been made to that of the urinary system. I propose tonight, therefore, to consider some of the principles of urinary surgery, and Murphy's work in relation thereto.

RENAL FUNCTIONAL TESTS

One of the first principles of urinary surgery, and one which Murphy continually stressed throughout his teaching, is that the state of the renal function as a whole must be thoroughly appreciated before any capital operation is performed upon the kidney, or, indeed, upon any part of the urinary tract. It is essential to know beforehand not only that there is a second kidney actually present, but also that the functional capacity of that kidney is sufficiently good to carry on life, should its fellow require to be removed. In precystoscopic days it was often quite impossible to obtain this information, and disaster was not infrequent. My old chief and predecessor in the chair of surgery once confessed to me that during his 35 years of practice he had on three occasions removed a patient's only working kidney. Such errors, though at that time unavoidable, are quite inexcusable since the advent of the cystoscope and the many tests of renal function. These

[1] Surg., Gynec. & Obst., 1907, April.

have enabled us to measure the functional capacity of the kidneys, either conjointly or separately, with an accuracy that is truly remarkable and which compares very favorably with that obtainable in any other system of the human body. Would that we could size up the functional activities of the liver, for instance, with the same precision that we can those of the kidney.

Of the many tests of renal function that have from time to time been proposed, the surgeon is chiefly concerned with those which, while trustworthy, are yet readily practicable. These comprise on the one hand the biochemical tests of the blood for nitrogen retention, and, on the other hand, the tests of the powers of the kidneys to eliminate either *endogenous* products, e.g., urea, chlorides, or *exogenous* substances like indigocarmine or phenolsulphonephthalein. Of the blood tests, the estimation of the urea-nitrogen is that most commonly employed, from 15 to 40 milligrams per 100 cubic centimeters of blood being considered the limits of normality. The most frequently used of the *endogenous* kidney elimination tests is, in England, Maclean's urea concentration test, and this, with the modification suggested by Calvert[1] in which, by suitable administration of fluids, the range of urea concentration from the most dilute to the most concentrated can be readily estimated, constitutes probably one of the very best tests in present use. Of the *exogenous* elimination tests, the "indigocarmine" and the phenolsulphonephthalein tests are the two most favored. The latter is certainly the better quantitative test, but the former has an exceedingly high qualitative value and is particularly useful in detecting differences in function between the two kidneys; moreover, it does not require catheterization of the ureters. After 30 years' use of this test in every urological case under my care, I have acquired great confidence in its findings. After the intravenous injection of 10 cubic centimeters of a 0.4 per cent solution of indigocarmine, the dye appears at the ureteral orifice within from 3 to 5 minutes in 95 per cent of normal kidneys, the limits of normality being from 2 to 7 minutes. If delayed beyond this, or if the initial light blue shoots do not quickly deepen to the typical dark blue, then disease of the corresponding kidney must be suspected. Valuable differential information is obtained by comparing the efflux from the two orifices as to the time of first appearance of the dye, the depth of tint, the frequency of the shoots, and the force with which they are ejected. I regard the indigocarmine as the most practical renal elimination test we possess for systematic ward use, but reliance should never be placed on any single test—two or more ought to be applied in every case, and in my wards the blood-urea, urea-concentration, and indigocarmine tests are used routinely in all cases.

Though *urography* (including pyelography, ureterography, cystography, urethrography, and vesiculography), when performed by the older method of introducing opaque media directly into the urinary tract ("retrograde" or "ascending" urography), yields most valuable information of the anatomical shape, size, and position of its various component parts, yet it gives no evidence of the renal function. In 1923, attempts were made to remedy this by introducing a shadow casting substance into the circulation so that, on its excretion by the kidneys, radiography would reveal the outlines of the renal pelves and ureters. Thus in America, Osborn, Sutherland, Rowntree and Scholl; in Germany, von Lichtenberg and Rosenstein, and Volkmann used for this purpose intravenous injections of 10 per cent solution of sodium iodide. Roseno, of Cologne, later experimented with a compound of sodium iodide and urea (pyelognost) and obtained good pictures, but found that toxic symptoms occasionally followed. In 1929, M. Swick, in Berlin, who worked with Lichwitz and later with von Lichtenberg, used a drug which had been synthetized by Binz and Raeth for use against coccus infections of the biliary and urinary tracts—selectan neutral, and later still uroselectan, which is the sodium salt of 5 iodo-2 pyridon N-acetic acid. Von Lichtenberg, from a study of seven contrast media in over 2,000 cases advocates a preparation—"D.40"—known as uroselectan B, which can be used in much smaller doses, gives a deeper shadow, is less toxic, reaches

[1] Brit. M. J., 1925, i, 64.

its highest concentration in 15 minutes, and is eliminated in 15 to 30 minutes; it is shortly to be placed upon the market. Researches are now in progress with compounds of bromine, which are stated to be safer and less costly than those of iodine, and there is no doubt but that in the near future substances will be discovered still less toxic and yielding a denser shadow on radiography. This method of "excretion" or "intravenous" urography promises, therefore, to be of the greatest value to urology—it may, indeed, prove epoch-making.

The more usual "retrograde" or "ascending" pyelography necessitates ureteral catheterization, and thus intravenous pyelography has the advantage that it can be used where this is difficult or impossible, as in impassable obstructions of the ureter or urethra, in small contracted bladders, in severe vesical hæmorrhage, in children and especially in male children, and in cases in which ureters have been previously transplanted into the colon. Moreover, it yields bilateral pyelograms without the risk, inherent in the "retrograde" method, of conveying infection in septic and tuberculous cases, and thus settles the oft-debated question as to the propriety of simultaneous bilateral pyelography. Its routine employment will bring to light many otherwise unsuspected anomalies of the urinary tract—duplicate pelves and ureters, ectopic kidneys, etc.—while above all other advantages it has the outstanding merit of yielding some indication of the state of the renal function.

Intravenous pyelography must not, however, be regarded as a substitute for, but rather as complementary to retrograde pyelography, and if the renal function is so defective that the drug is not excreted in sufficient quantity to cast a recognizable shadow the latter will still be required. Both methods fail where poor renal function is combined with ureteral obstruction. The depiction of the normal renal pelvis on an "intravenous" pyelogram is decidedly different from that on a "retrograde" one: in the former, the pelvis fills physiologically from above while in the latter it is artificially distended from below. Intravenous urography has shown us that there is a definite systole and diastole of the renal pelvis, and that in the normal state the pelvis is almost completely filled. The normal ureter exhibits active peristalsis which prevents it from being completely outlined, and presents definite sites of narrowing with intermediate dilatations, which might be interpreted erroneously as indicative of ureteral strictures.

RENAL BACK PRESSURE

Another principle to which Murphy constantly referred in his clinical teaching, and one, moreover, applicable to systems of the body other than the urinary, is that long standing pressure upon an organ or system should never be released suddenly, but always gradually. The evil effects of pressure are well known, and if this be brought to bear suddenly upon an organ it may lead to its rupture, or, short of that, to damage more or less irreparable. If, however, increasing pressure be applied slowly, so great is the adaptability of the human tissues to altered circumstances that compensatory mechanisms arise which delay, for a time, its injurious effects, although, unless such pressure sooner or later be alleviated, destruction of the organ or system is ultimately inevitable. If sudden relief be given, there may follow such a repercussion as even to exceed in its noxious effects the original pressure, whereas gradual alleviation may lead to recovery, the completeness of which will vary inversely with the delay in its application. It can, in fact, be laid down as a general principle that the greater has been the pressure the more gradually should it be relieved.

Apart from the urinary tract this principle, as was pointed out by Sir W. de Courcy Wheeler,[1] finds its application in the relief of such pressure conditions as chronic obstructive jaundice, ascites, intestinal obstruction, pleuritic effusion, empyema, intracranial hypertension, hæmatocolpos, hydramnios, glaucoma, and back pressure upon the heart from disease and narrowing of the arteries. The best illustration, however, is afforded in the treatment of "back pressure" upon the kidneys such as occurs with a progressively increasing obstruction from the prostate gland.

[1] Brit. M. J., 1930, Aug. 30.

Once the prostate gland, whether enlarged or not, commences to impede the urinary stream, from that moment onward the whole of the urinary tract proximal to the prostate inevitably suffers. The bladder undergoes, at first, hypertrophy of its muscular wall and, later, dilatation; the ureters next become dilated from below upward; the back pressure is then thrown upon the renal pelves which also, in their turn, are dilated; next, the calyces are similarly affected and pressure is thus reflected upon the renal tubules themselves, leading to thinning of the renal parenchyma and finally to atrophy of the renal epithelium.

Doubtless the most important etiological factor in producing these results of back pressure is its restrictive effect upon the vascular supply of the kidney; this leads to defective nutrition of the renal tissues, later to actual disorganization of the renal epithelium, and finally to complete renal bankruptcy.

Clinical manifestations of these changes may not be apparent until they are well advanced, since nature has granted us a fairly generous reserve of renal tissue over and above our actual necessities. In the later stages, however, we note a dry skin, great thirst, loss of appetite, loss of weight, nausea, and even vomiting, fairly constant headache, the passage of large quantities of urine of a low specific gravity, and much diminished urea content, a low result from the "urea-concentration" test and other tests of renal function, and an increased blood-urea content. If the back pressure continues unrelieved, gradually increasing coma supervenes and heralds death.

These back pressure effects are seen in their most extreme form in those cases of "silent" distention of the bladder, not infrequently associated with a small fibrous contracted prostate or with a small so called "midlobe" enlargement. I know of no less desirable type to have as a patient than this, nor one whom, if a surgeon were mainly intent upon being able to record favorable operation statistics, he would more willingly hand over to the care of a professional rival. The patient walks into your consulting room feeling perfectly well and often looking so, complaining only that he "makes too much water," which is the layman's mode of expressing frequent micturition. The bladder is found to be distended to the level of the umbilicus or beyond, yet without arousing in him the slightest sensation of distention; his urine, passed frequently and in very small quantities, is but the "overflow" from the hugely distended bladder; it is clear, very pale, with a urea-content of 0.5 per cent or less, while his blood-urea may be from 100 to 300 milligrams per 100 cubic centimeters of blood, or even higher. He scoffs at the idea that there is anything seriously wrong with him, and yet, notwithstanding, he is on the very brink of uræmia. The immediate cause of his dangerous state is not the actual pathological condition of his prostate but the back pressure effects it has produced upon his kidneys; hence our first concern is the release of the kidneys from such back pressure rather than the removal of the prostate—that is for future consideration.

This opens up the interesting question as to what should be our main reason, as surgeons, for ever recommending a patient to undergo the operation of prostatectomy, especially if he be only in the early stages of his trouble. The patient's mind is concentrated upon the purely local effects—the difficulty and frequency of micturition, etc.—and it is the removal of what he regards merely as nuisances that reconciles him to the radical operation. The surgeon, however, taking a much broader view of the present and future, advises prostatectomy for a very much stronger reason than the removal of a mere nuisance: he advocates it as a measure designed primarily to prevent progressive destruction of the kidneys. It cannot be too strongly emphasized that a patient with even a slight degree of prostatic obstruction cannot possibly have perfectly healthy kidneys; from the first moment of obstruction the kidneys commence to suffer; prostatic obstruction and healthy kidneys are as incompatible as are heat and cold.

If this renal back pressure be released suddenly, as by completely emptying a chronically distended bladder at one catheterization, then a characteristic sequence of events is frequently observed. The next urine that is

passed spontaneously or is withdrawn by catheter, contains blood, the hæmorrhage being of renal rather than of vesical origin. This hæmaturia may last for 2 or 3 days only, or it may continue to the end. The urine steadily diminishes in quantity and deteriorates in quality, the patient becomes increasingly drowsy, and all the signs of uræmia appear within about 14 days of the first catheterization—coma and death supervening shortly afterward. It is because of this comparatively long interval of from 12 to 15 days between the first catheterization and the fatal issue, that many practitioners fail to recognize the causal relationship of the one to the other. I well remember an enthusiastic house surgeon who, when I entered my wards one morning, proudly greeted me with the information that he had just withdrawn 80 ounces of urine from a case of prostatic obstruction; I recall also how his countenance changed from one of pleasure to one of pained and surprised incredulity when I gently hinted that he had possibly also withdrawn the man's only chance of recovery; and how, unfortunately, this proved so, since death from uræmia occurred on the fourteenth day. The risk of catheterization in chronic prostatic obstruction cannot be too strongly emphasized; it constitutes a risk considerably greater than that of many major abdominal operations, and one that should never be undertaken save under appropriate physical and aseptic conditions. The excuse of urgency cannot here be pleaded, as it might possibly be in a case of acute prostatic obstruction, since in chronic obstruction the patient is not in distress, and is usually quite unaware of the distended state of his bladder.

Sudden release of long standing back pressure upon the kidneys leads to congestion of the previously compressed vessels with consequent acute œdema of the renal parenchyma; this often proves to be the "last straw"; it arrests the already seriously damaged functional capacity of the renal cells, renders the kidneys more susceptible to infection, and tilts the scale against the patient's recovery. On the other hand, if only the back pressure can be relieved so gradually as to avoid renal congestion and œdema, the renal function may then steadily improve, as evidenced by the disappearance of headache and thirst, a fall in the blood-urea, and a general amelioration in the various renal functional tests. Certain of the renal cells are so seriously damaged by the long standing back pressure as to be quite beyond repair, many others though considerably impaired are yet capable of varying degrees of recovery, while even under the most adverse circumstances a few cells doubtless escape entirely and may actively assist in the processes of regeneration and compensatory hypertrophy.

The various methods of effecting gradual renal decompression, many of which exhibit considerable ingenuity, need not be referred to in detail—the more gradually and continuously they act the greater their safety. Campbell[1] has shown that in cases of retention the sudden withdrawal of only 30 cubic centimeters of urine reduces the intravesical pressure by 25 per cent, and of 120 cubic centimeters by 50 per cent. It follows, then, that methods in which small quantities of urine are withdrawn at regular intervals are less safe than those where a slow continuous escape is permitted. My own preference is for a slight modification of the Shaw-Young apparatus[2]; in the less severe cases a "dropper" such as that supplied with many apparatus for continuous proctoclysis, if attached to an indwelling catheter, allows control of the urinary flow.

In the most serious instances, however, and especially in those of that "silent" distention of the bladder to which I have already referred, decompression should commence with medical rather than surgical measures—rest in bed, warmth, vapor baths, milk diet, restriction of fluids, diaphoretics, and saline purges. When by these means the fundus of the bladder has been induced gradually to recede below the umbilicus, decompression may be continued with an indwelling catheter connected to the Shaw-Young, or other controlling apparatus.

SYMPTOMLESS HÆMATURIA

An important principle in urinary surgery is that hæmaturia should never be regarded

[1] J. Urol., 1927, xvii, 371.
[2] J. Urol., 1924, xi, 373.

lightly. While hæmorrhage from other sources may not necessarily be of serious import—e.g., epistaxis, bleeding from hæmorrhoids—hæmaturia is always of weighty significance and should invariably receive the closest attention. Fortunately, for the diagnosis of its cause, hæmaturia is usually accompanied by other symptoms of urinary disorder—pain, frequency of micturition, pyuria, etc.—which assist in its interpretation. A very interesting group, that of "symptomless" hæmaturia, is constituted by those cases in which hæmaturia is absolutely the only symptom of which the patient complains; indeed, many of them volunteer the statement that had they been blind, and so unable to detect the altered color of their urine, they would never have known there was anything wrong. Sometimes, however, if bleeding is so profuse as to lead to the formation of clots, pain may be caused by their passage along the ureter or urethra; such pain is a "side issue," and not being dependent upon the actual cause of the hæmaturia, does not remove the case from the class of "symptomless" hæmaturias.

Hæmaturia of this type may arise from diverse pathological conditions; in fact, any disease of the urinary tract may occasionally so first declare itself, though with most of them this is very exceptional. In 1927, I analyzed 200 cases that had come under my own observation with the following results:

A. The hæmaturia was of vesical origin in 119 cases:

1. Villous papilloma	76
2. Malignant neoplasm	30
3. Enlarged prostate	6
4. Simple solitary or "mucous" ulcer	3
5. Appendicular abscess adjacent to bladder	2
6. Ulceration from suture left after colporrhaphy	1
7. Calculus fixed in postprostatic pouch	1

B. The hæmaturia was of renal origin in 81 cases:

1. Bleeding not occurring at time of examination, the side of hæmorrhage and cause unknown	30
2. Malignant neoplasm, including hypernephroma	23
3. Renal and ureteral calculus	9
4. "Essential" or "idiopathic" hæmaturia	8
5. Chronic nephritis	3
6. Mobile kidney	2
7. Papilloma of renal pelvis	2
8. Angioma of renal papilla	1
9. Papilliferous cystadenoma of renal papilla	1
10. Congenital cystic kidney	1
11. Renal tuberculosis	1

Of the 170 cases of symptomless hæmaturia definitely traced to their origin, 53, i.e., 31.1 per cent, were due to malignant neoplasm and 86, i.e., 50.5 per cent, to benign neoplasm. Of the renal hæmaturias of known origin 45 per cent were from malignant neoplasm, while of the vesical hæmaturias only 25.1 per cent were associated with malignancy.

"Essential" or "idiopathic" hæmaturia is a purely clinical diagnosis, indicating renal bleeding of unknown origin. Such a title merely cloaks our ignorance and is one against which every scientific mind must necessarily revolt. Murphy himself was very skeptical of the reality of idiopathic hæmaturia, and he definitely stated that, in his experience, blood in the urine always indicated disease in the urinary tract. Yet, in one of his clinical lectures, he referred to a case in which Senator, of Berlin, had removed a kidney for extreme exsanguination from "idiopathic" hæmaturia, and which, on subsequent microscopic examination, failed to reveal any cause for the hæmorrhage. Many of us must have had a similar experience. While a refusal to recognize the existence of "idiopathic" hæmaturia is, therefore, a stimulus to utilize every possible means of investigating its cause, nevertheless the disquieting truth remains that a kidney may take upon itself to bleed, and to bleed so furiously as to threaten death from hæmorrhage and necessitate nephrectomy for its arrest, and yet its subsequent careful examination, macroscopic and microscopic, by a skilled pathologist may fail to disclose any abnormality whatsoever. I have met with three such cases, and they certainly arouse the uncomfortable reflection that there is no very obvious reason why hæmorrhage should not recur from the remaining kidney; though such has not occurred in my own experience, yet it has been recorded by others—when further radical surgery is, of course, impossible.

In symptomless hæmaturia it is only by cystoscopy that the source of the hæmorrhage can be determined with certainty, and this should be regarded as a matter of extreme urgency, particularly if bleeding is actually occurring. If the hæmaturia be of renal origin it is only at this time that it can be traced to the defaulting kidney. Murphy constantly

insisted upon this point, and yet it still happens much too frequently that the practitioner's first efforts are directed, not to ascertaining the source of the bleeding, but to its immediate arrest; he puts the patient to bed and administers morphine and internal styptics. Although this course may allay the alarm which many patients not unnaturally feel at the discovery of blood in their urine, yet it may in the long run prove the greatest possible disservice; it is far preferable to allow the hæmorrhage to continue until arrangements can be made for a cystoscopic examination. Cystoscopy is here as urgently called for as is early laparotomy in acute abdominal crises, and if it be postponed until hæmorrhage has ceased it will probably fail, in renal hæmaturia, to indicate its source.

When, through the cystoscope, blood has been observed to escape from one ureteral orifice only, a thorough investigation must be instituted by all the usual urological methods to ascertain the pathological lesion in the corresponding kidney, including careful palpation of the loin, a chemical, microscopical and bacteriological examination of the urine and possibly also of the separated urines after ureteral catheterization, radiography, and pyelography. By these measures positive evidence may be obtained of certain conditions, e.g., calculus, neoplasm, or tuberculosis, but when their findings are entirely negative the interesting question arises whether we are to treat the bleeding expectantly, as by the injection of a solution of silver nitrate or of adrenalin into the renal pelvis, the administration of calcium lactate, or the intramuscular injection of horse serum, or whether we should explore the kidney operatively. Those who advocate the latter do so mainly because of the fear that otherwise an early malignant neoplasm might be overlooked. Though I am aware that most American writers favor expectancy, my own inclination is toward exploratory nephrotomy, and only when this has been undertaken with a negative result do I care to label the hæmorrhage as "idiopathic" or "essential." It was exactly under such circumstances that the two earliest malignant renal neoplasms I have ever operated upon were discovered, and both these patients are alive and well 8 years and 4 years respectively after nephrectomy. In carrying out this exploratory nephrotomy, the kidney is exposed from the loin, and, along with the upper end of the ureter and renal pelvis, is examined carefully by palpation. If nothing abnormal is revealed the ureter is separated from the rest of the pedicle, which is then compressed by a rubber covered clamp to control hæmorrhage, and the renal parenchyma is freely incised a little posterior to its coronal plane until the pelvis and calyces are widely opened. If no macroscopic lesion be found, a small slice of the parenchyma is removed for microscopic examination, and the kidney is then carefully sutured with deep and superficial catgut sutures. The case is now regarded as one of "idiopathic" hæmaturia, and, should the hæmorrhage ever recur, it may be treated expectantly with the confidence that a malignant growth has not been overlooked; only when the bleeding returns so profusely as immediately to threaten life should further operative treatment, i.e., nephrectomy, be considered.

Renal sympathectomy, i.e., complete denervation of the vessels in the renal pedicle, of the pelvis, and of the upper inch of the ureter, has been suggested by S. H. Harris and R. G. S. Harris,[1] of Sydney, in the treatment of "essential" hæmaturia, and in the one case in which they had performed this operation there had been no recurrence of bleeding for more than 14 months.

EARLY SYMPTOMS OF RENAL TUBERCULOSIS

One of the most characteristic features of Murphy's clinical teaching was the extreme importance he so consistently attached to an accurate account of the early history of the complaint under consideration, and especially to the order of onset of the respective symptoms and signs. Woe to that interne who, when called upon to read his notes of the case about to be demonstrated, had not the order of onset of the symptoms correctly stated; very quickly, and often very facetiously was he called to account. Acute appendicitis furnishes the best example of the value of this accurate history, and Murphy's description of

[1] Brit. J. Urol., 1930, ii, 367

the order of onset of its symptoms is one that will long remain classic. In the differentiation of renal conditions Murphy was equally insistent upon the value of the onset symptoms: in renal calculus it is pain that is expected, in neoplasm it is hæmaturia, while in renal tuberculosis it is increased frequency of micturition. He pointed out that when tuberculosis starts in the parenchyma the order of onset of the symptoms is, first, increased frequency of micturition unassociated with any increase in the amount of urine though later polyuria supervenes; second, an increased number of leucocytes in the urine scarcely worthy of the designation pyuria: and, third, hæmaturia. If, however, the tuberculous process commences in the mucosa of the renal pelvis these three symptoms—dysuria, pyuria, and hæmaturia—commonly appear simultaneously.

The subject of renal tuberculosis had a profound personal interest for Murphy, for in 1883, while a post-graduate student in Vienna, he had a sharp attack of hæmaturia, which a Viennese professor, whom he consulted, ascribed to tuberculosis of the right kidney; he was on that account advised to leave Europe. The hæmaturia soon ceased and never recurred, nor is there any record of the tubercle bacillus ever having been found, though throughout his life he had slight transitory albuminuria after great exertion or following any special mental strain. Casts were never seen and only occasionally a red blood cell. He always considered this albuminuria to be of the "fatigue" type, analogous to that found in young soldiers after a forced march. At the autopsy upon Murphy, which he had himself requested should be made, his right kidney was found to be very small, measuring only 3 by 2 by 2 centimeters, with the pelvis and ureter still patent. Histological examination disclosed considerable proliferation of the connective tissues with some proliferation of the endothelial cells of the capillaries and the production of new capillaries; there were no giant cells. The opinion formed was that the condition represented a chronic persistent infection of the right kidney, due, probably, to some organism other than the tubercle bacillus. The left kidney was considerably enlarged, having undergone compensatory hypertrophy. The cause of death was angina pectoris from atheroma of the coronary arteries, and this was regarded as an infection-metastasis from the 33 year old infection of the right kidney. His friend, Dr. W. A. Evans, has expressed the opinion that, had the right kidney been removed in 1883, or at any time within 20 years after, the arteritis would have been prevented.

The evolution of our knowledge of urinary tuberculosis, particularly the great progress made in its earlier recognition constitutes one of the most interesting and beneficial advances in urology that have occurred within our time. Regarded at first as primarily of vesical origin and, in consequence, as being beyond the scope of radical surgery, the disease ran its course practically uninfluenced by treatment. The pain and frequency of micturition steadily increased to such an extent that, toward the last, life became almost one prolonged and painful act of micturition from which death could not be regarded as other than a most merciful release. It was from the cystoscope we learned that even in fairly advanced cases ulceration was definitely more marked around one of the two ureteral orifices, and that at an earlier stage it was limited thereto, or even absent. This led to the discovery that the bladder was not the initial site of the disease but that it was attacked by extension along one of the ureters from a primary focus in the corresponding kidney. Timely removal of that kidney, it was soon learned, could prevent the spread of the disease to the bladder. Our present day ability to recognize the existence, and often also the extent of tuberculous change in a kidney from the cystoscopic appearance of the corresponding ureteral orifice, and this we owe largely to the work of my fellowcountryman, E. Hurry Fenwick, always appeals to me as the most fascinating of the cystoscope's innumerable and priceless contributions to urology.

In spite, however, of considerable progress in the early diagnosis of renal tuberculosis we are not yet in a position to recognize it with any certainty until it has invaded the renal pelvis. So long as the changes are confined to the parenchyma, renal tuberculosis remains one of the "silent" diseases, and we are not

infrequently astounded at the advanced destruction of the kidney that may occur before that "silence" is broken. In visceral tuberculosis, considerable importance was attached by Murphy to the slight constitutional disturbances which precede the local manifestations. "Whenever you get a history of gradual deterioration of the general health of a patient, the first question you should ask yourself is 'Is this the initial stage of a tuberculosis?'."

Murphy considered renal tuberculosis to be usually a hæmatogenous infection, the bacilli entering the blood by way of the lymph stream from a primary focus in the bronchial glands. He admitted, however, the occasional occurrence of an "ascending" infection along the ureter from the bladder, prostate, seminal vesicle, or epididymis, and, rarely, infection by extension from the perinephric tissues. He believed (1) that in visceral tuberculosis tubercle bacilli may be found in the urine even in the absence of a tuberculous focus in the kidney, (2) that in the great majority (80 to 90 per cent) of early cases the disease is unilateral, and (3) that early cases can be cured by non-operative measures, prominent among which he placed the injection of tuberculin.

In the first and second of these beliefs, Murphy was in accord with the views prevalent at that time, but, with regard to the third, most authorities then taught that chronic renal tuberculosis, if left to run its natural course, inevitably advanced to complete destruction of the kidney and progressive involvement of the rest of the urinary tract; arrest of this extension could be achieved only by the surgical operation of nephrectomy, or by nature's operation of "auto-nephrectomy," i.e., the isolation of the affected kidney from the rest of the urinary system by progressive thickening and, finally, complete obliteration of the lumen of its ureter.

In the 15 years that have elapsed since Murphy's death, although considerable discussion has ranged around these same three questions, and much clinical and experimental investigation has been carried out, no general agreement has yet been reached. Many recent workers, Dyke and Lepper, Medlar, Helmholz, Thomas and Kinsella, Bumpus and Thompson, Harris and others, now hold (1) that "secretory bacilluria" does not exist, and that the presence of the tubercle bacillus in the urine from a kidney denotes the actual existence therein of a focus of tuberculosis, even though microscopic only; (2) that renal tuberculosis is at first a bilateral condition; and (3) that the initial renal lesions frequently heal. Wildbolz, of Berne, however, whose right to speak with authority upon renal tuberculosis will be universally admitted, in an address to the American Urological Association at Chicago in June, 1928, adhered very strongly to the older views. He maintained that "secretory bacilluria" is a reality, and that tubercle bacilli may pass through the kidney and appear in the urine without producing any macroscopic evidence of tuberculous tissue change and without causing the admixture of pus with the urine. Further, he expressed himself convinced that chronic renal surgical tuberculosis as met with clinically is primarily unilateral, and shows no tendency to heal.

In spite of these divergent views the surgical position of today does not differ materially from that of Murphy's time. Renal tuberculosis, if clinically unilateral, should be treated by nephrectomy, whereas in clinically bilateral involvement nephrectomy should be performed only very exceptionally, as when there is severe pain, hæmorrhage, or acute sepsis in a tuberculous kidney, whose fellow is but slightly affected.

Whether the whole of the ureter or part only should be removed along with the kidney has been much discussed. Though I am well aware that many good results have followed nephrectomy with the excision of only so much of the ureter as could be reached readily from the lumbar incision, yet my own practice is to excise the whole ureter and kidney together in one unbroken piece, first exposing the ureter extraperitoneally through a "gridiron" incision in the iliac fossa, freeing it and dividing it with the electric cautery at its entrance into the bladder, and then removing it along with the kidney and as much as possible of the perinephric fatty tissue through a second incision made in the loin. After this procedure I believe that the symptoms, particularly the frequency of micturition will be

more quickly relieved than when any portion of the tuberculous ureter is left behind.

CONSERVATISM IN UROLOGY

The principle of the conservation of such portions of a defective organ as are still capable of further efficient function appealed forcibly to Murphy, who, moreover, always taught that only the minimum of trauma necessary for the actual fulfilment of its purpose should be inflicted upon the tissues in the course of a surgical operation. This is well illustrated by his attitude toward the surgery of renal calculus. In the early period of operations for this condition the stone was extracted through an incision, often of considerable extent, in the convexity of the renal parenchyma. This entailed a varying degree of trauma to the renal tissue, was sometimes attended with profuse hæmorrhage, and carried with it a definite risk of a subsequent fistula. To minimize these drawbacks, Murphy, from 1890 onward, adopted the method of extracting the stone through an incision made directly into the renal pelvis ("pyelolithotomy") which he afterward closed by suture. He had a profound respect for the healing powers of the renal pelvis and of the ureter, and considered that wounds of these structures heal more readily than those of any other tissue in the body with the exception of the peritoneum. This operation of pyelolithotomy has since become the generally accepted procedure for renal calculus, and where it is impracticable, as when the calculus is situated in the cortex and especially when multiple, one or more small cortical incisions, made with due regard to the direction of the main arterial branches, have replaced the free coronally placed incision of former times. Only when the renal parenchyma has been very extensively destroyed or where there is very severe accompanying septic infection, ought nephrectomy to find any place, nowadays, in the treatment of renal calculus.

The frequency of *recurrence of renal calculus* after operative removal is difficult to estimate since there is no doubt but that, as in the analogous case of gall stones, many so called recurrences are really "left-overs" from the previous operation. This overlooking of a stone during pyelolithotomy or nephrolithotomy, and the leaving behind of fragments of calculi or of particles of calculous débris are two of the most important etiological factors in "recurrence." The former can be avoided by fluoroscopy of the kidney exposed in the wound, as advocated by Braasch,[1] or by radiography of the kidney and rapid development of the film before closing the wound, as recommended by Quinby,[2] and others. Careful lavage of the pelvis and calyces with saline solution, especially if combined with the use of a suction apparatus, will assist in the removal of fine calculous particles. In view of the important part that infection plays in the etiology of renal calculus, careful search should be made in other regions for any septic focus; any such should, if possible, be thoroughly eradicated or, if this be impossible, its effect must be minimized by careful antiseptic treatment, both before and for a prolonged period subsequent to operation.

Postoperative treatment by urinary antiseptics including, if necessary, renal lavage should be continued until the urine becomes sterile. As in so many other surgical conditions, the actual operation is only one—the starting—factor in the treatment of the patient; by appropriate after-care alone can the frequency of recurrence of renal calculus be minimized.

It is in connection with *hydronephrosis* that conservative surgery has scored its most pronounced successes. Pyelography, in combination with the various tests of renal function can furnish us with a fairly accurate estimate of the degree of distention of the pelvis and calyces, and of the functional capacity of the renal parenchyma—both date of prime importance in deciding whether conservatism is worth the attempt. It has been frequently stated that excessive mobility of a kidney may itself, by kinking the ureter, produce hydronephrosis; in my experience, however, there has invariably been some other factor in association, such as a congenital or an inflammatory stricture at the ureteropelvic junction, bands or adhesions distorting the ureter into valvular form, or an aberrant blood

[1] J. Urol., 1924, xi, 525.
[2] J. Urol., 1925, xiii, 59.

vessel connected with the lower pole of the organ and over which the upper end of the ureter has become strongly angulated. Murphy, with his intense faith in the reparative powers of the ureteral and pelvic tissues, dealt with these cases not only by wide excision of valved or strictured segments and the subsequent re-implantation of the ureter into the most dependent part of the pelvis, but he also resected very freely the redundant pelvic wall so as to reduce it to approximately normal dimensions.

Obstruction from kinking of the ureter over an aberrant blood vessel can be relieved by division of the latter between two ligatures. If large, however, its severance may lead to atrophy of a considerable area of the renal parenchyma, and it may prove more truly conservative to preserve the vessel and to section the ureter instead, reuniting the divided ends well away from the constricting vessel, as advised by Quinby.[1] Owing to the difficulty in suturing so small a tube as the ureter, Patch[2] prefers to divide the pelvis just above the ureteropelvic junction, rather than the ureter itself, thereby obtaining much broader surfaces for reunion after the ureter has been freed from constriction.

The conservative tendency of modern urology is further noticeable in a consideration of the surgical aspects of *developmental anomalies* of the urinary tract. Largely on account of the complexity and intricacy of its embryology the urinary system, above all the other systems of the body, is peculiarly liable to abnormal variation. Recognized at first only at autopsy as interesting embryological diversities, and at a later period discovered accidentally during the course of abdominal operations, it is only since the general adoption of modern methods of urological investigation, more especially of urography, that the comparative frequency of these abnormalities has become known, their relationship to coexistent lesions of the urinary system established, and appropriate measures taken, in certain cases, for their relief. It seems highly probable that in the near future the recently introduced "intravenous" method will very materially extend the routine use of urography, and that our knowledge of these anomalous conditions will be correspondingly increased. A large proportion of them do not in any way interfere with perfect body function and their only clinical importance is their possible effect upon coexistent pathology; on the other hand they may occasionally be the source of much distress, as when a malplaced ureteral orifice, opening into the vagina or urethra leads to incontinence of urine. Unilateral kidney, and the single "fused" kidney can nowadays be recognized with certainty by cystoscopic and pyelographic methods, and that most terrible catastrophe of past times—the removal of an only kidney—safely averted. Supernumerary, polycystic, and horseshoe kidney can all be demonstrated pyelographically, as can also the multiplicity and diversity of situation, almost bewildering in their complexity, of the ureters and renal pelves. The increasing frequency with which, where disease affects one half only of a duplicated kidney, heminephrectomy is nowadays performed, augurs well for the future of conservative urology. Even in solitary kidney, as shown by Walters and Wright[3] timely operation, and even repeated operations can be undertaken under modern urological conditions with good prospect of success.

In *tuberculosis of the epididymis*, Murphy was a forceful advocate of the conservative operation of epididymectomy as opposed to castration. He wrote: "There is no more occasion for taking out the testis proper in the early stage of tuberculous epididymitis than there would be for taking off the caput coli if you had a case of appendicitis. The testis can be saved if you operate in time." He believed emphatically that genital tuberculosis in the male always starts in the epididymis, most frequently in the globus minor, and that it spreads thence along the vas deferens to the vesiculæ seminales, prostate, and base of the bladder. The treatment Murphy recommended was the removal of the epididymis and as much of the vas as could be reached from the groin; he never excised a seminal vesicle, and shortly before his death stated that he had never seen a case presenting

[1] J. Am. M. Ass., 1927, lxxxix, 841
[2] Brit. J. Urol., 1929, i, 373.
[3] Surg., Gynec. & Obst., 1930, li, 836.

clinical evidences of tuberculous involvement of a seminal vesicle that did not entirely heal after epididymectomy, without further operation. These views, as is well known, are strongly opposed by Young who considers tuberculous infection of the epididymis to be secondary to that of the seminal vesicles. On this opinion he bases his radical procedure, in genital tuberculosis, of excision of both seminal vesicles, ampullæ, and lateral lobes of the prostate together with the whole of the vas and the epididymis on the affected side. Young and Murphy both agree, however, in protesting emphatically against the unnecessary removal of the testis which hitherto has been so frequently practiced.

Further evidences of the present day healthy conservative reaction in urology are shown in the greatly diminished number of operations that are now performed of nephropexy, of renal decapsulation, and for the cure of varicocele. Calculi are now frequently removed from the lower portion of the ureter by endoscopic methods, ureteral transplantation has replaced nephrectomy after accidental injury of the ureter during surgical operation, and there is an increasing tendency to adopt "punch" operations, high frequency electrosection, or other methods of less severity than prostatectomy in the management of certain types of prostatic obstruction. Owing to the earlier recognition of strictures of the urethra, and the more effective employment of dilatation in their early treatment, the operations of external and internal urethrotomy are much less frequently required, while the endoscopic application of diathermy to benign vesical neoplasms and of radium to those of a malignant nature must have materially reduced the number of suprapubic cystotomies that otherwise would have been performed.

PROSTATECTOMY

In his earlier work in the field of radical prostatic surgery Murphy removed this gland by the perineal route. Later, inspired by the Italian surgeon, Bottini, who, in 1876, had commenced to treat prostatic obstruction by division of the "bar," or the enlarged middle lobe with a thermogalvanic cautery passed *per urethram*, Murphy treated several cases by division of these structures with the thermocautery, not blindly, however, through the urethra, as did Bottini, but under direct vision after exposure by suprapubic cystotomy. The results were not encouraging and he returned to perineal prostatectomy, which at that time he considered preferable to the suprapubic operation. Thus, in 1902, he wrote: "Suprapubic prostatectomy should be limited to exceptional cases of enormous intravesical enlargement of the prostate. The perineal operation is the most direct and the least bloody." In 1903, he recorded 32 cases, and in the following year 51 cases with only one death. From this time onward, however, Murphy seems to have regarded the suprapubic route with steadily increasing favor, and shortly before his death in 1916 he stated: "We remove all our prostates by the suprapubic route. If, however, we have a superlatively small prostate in a thin man we perform the perineal operation."

This gradual change in Murphy's attitude toward perineal prostatectomy is typical of that of the majority of surgeons whose work has covered approximately the same period, and the oft-debated question as to the relative merits of perineal and suprapubic prostatectomy would appear to have been settled, for the present at any rate, in favor of the latter. Nevertheless, you have in this country the world's greatest perineal prostatectomist in the person of Dr. H. H. Young, the very arch-protagonist of the operation itself. Of all the surgical operations I have witnessed in the course of my travels, the most perfect anatomical and surgical demonstration was one of perineal prostatectomy, performed at Baltimore by Dr. Young. Every step was exquisitely shown, and to the onlooker it could appear only in keeping with the general fitness of events that Dr. Young's mortality for this operation is the smallest on record. At the hands of the average surgeon, however, and not of a super-surgeon, perineal prostatectomy carries with it the two dangers of wound of the rectum and of defective sphincteric control, and these, combined with the greater ease of performance of the suprapubic operation account for the present day preference for the latter.

Looking back upon the question, so heatedly debated during 1902–3 of the priority of performance of suprapubic prostatectomy, it is interesting to note that Murphy believed the honor to belong to W. T. Belfield of Chicago who was, he states, the first to follow a deliberate plan for the removal of a midlobe of the prostate through a suprapubic incision. He performed this in 1886, and published the case in the following year. That it was deliberately planned, and was not, as G. Buckstone Brown had suggested, an accidental occurrence, was well known to other surgeons in Chicago. McGill, of Leeds, without knowledge of Belfield's work, some 3 years later described a similar procedure based on an experience of 24 cases, and laid down more definite indications for its performance. The operations of Belfield and McGill were, however, partial procedures, and the first complete suprapubic prostatectomy appears to have been carried out by Eugene Fuller, of New York, in 1894. To Freyer, of London, must be accorded the credit of bringing the operation into the prominence it has since enjoyed, and this in spite of the fact that both his main original contentions—that he removed the entire prostate in its capsule, and that he left the prostatic urethra behind—have since been completely disproved. Murphy and others recognized that in the wall of the cavity remaining after suprapubic enucleation of the prostate there were compressed and atrophied remnants of prostatic glandular tissue, and that the operation was not, therefore, a complete prostatectomy. That the prostate can be totally removed with its capsule was acknowledged by Murphy who rightly stated, however, that it should never be undertaken except for malignant disease.

As to the time at which a patient should be advised to undergo prostatectomy Murphy considered that radical operation should be performed whenever, otherwise, catheter-life must be entered upon. He was led to this view by the impossibility of avoiding infection whenever the catheter has to be used over a prolonged period of time. He wrote: "You do not interfere with the prostate solely because it is enlarged. . . . The moment a man begins catheter life, no matter how cautious you are as to asepsis, no matter how well the catheter is used, it is only a question of time when the patient will have an infection of the bladder from the use of that catheter. Antiseptic precautions count for nothing. Urethritis from the use of the catheter, and sepsis of the bladder are bound to occur sooner or later." Most surgeons of the present day will fully endorse this opinion.

Risks of operation. When, at the close of the last century, prostatectomy came into vogue it was at first attended with a high mortality. This was due mainly to the operation having been performed in cases which would nowadays be considered quite unsuitable, and without proper regard to the state of the renal function—renal insufficiency being the most frequent cause of death. The general adoption of careful tests of the renal function before submission to prostatectomy, the postponement of the operation where these tests indicate defective function beyond the limits of safe operability, and the preliminary relief, in such cases, of any back pressure upon the kidneys by the institution of urethral or suprapubic drainage until such time as the renal function improves to within safe limits—all these factors have shared in steadily reducing the death rate of prostatectomy from renal insufficiency, while concurrent improvements in technique, particularly in the control of hæmorrhage, have lowered still further the general mortality. Renal insufficiency and hæmorrhage being thus deposed from their pre-eminence as mortal factors, it would appear that infection is the hazard most to be dreaded at the present time. Not until as much attention is paid to this danger as has been expended upon that of renal insufficiency can we hope for a further substantial reduction in the operative risks of prostatectomy. This infection may manifest itself as a localized sepsis of the operation wound, the prevesical space, the prostatic cavity, or of the epididymis, or it may assume a more general form—that of septic pyelonephritis. The more local manifestations should prove capable of prevention, once their importance as factors in mortality is recognized. The avoidance of any accumulation of fluid in the bladder by the use of a continuous or intermittent

suction apparatus, continuous antiseptic irrigation of the prostatic cavity, and its more effective drainage through a counteropening in the perineum or ischiorectal fossa as advocated by Fullerton of Belfast,[1] are all factors tending to minimize sepsis. Whether the same can be said of the method of primary suture of the prostatic cavity advised by Harris,[2] of Sydney, further experience alone will show.

Murphy constantly drew attention to the risks of infection of the prevesical space and laid great stress upon the importance of suturing the lower angle of the incision in the bladder, as soon as this is made, to the abdominal wall, thereby preventing the prevesical space from being widely opened up during the subsequent steps of the operation. Moreover, he invariably drained this space, whether he closed the bladder completely or not.

Epididymitis. Although epididymitis may occur in association with enlarged prostate quite apart from any operative procedure and may also arise during the period of preliminary urethral or suprapubic drainage of a two stage prostatectomy, yet it is the occurrence of this complication subsequent to the removal of the prostate that especially interests us. Its frequency has been variously estimated. Thus, H. P. W. White[3] on examining 50 consecutive cases that had survived prostatectomy at St. Peter's Hospital for Stone, London, found definite evidences of inflammatory change in the epididymis in 33 per cent, all of which occurred after the one stage operation. Randall[4] found epididymitis in 23 of 100 consecutive prostatectomies, and Alyea[5] in 39 per cent of his private ward and in 20 per cent of the public ward patients. The incidence of postoperative epididymitis is, in reality, greater even than these figures suggest, since this complication may not occur until several weeks or even months after patient leaves the hospital; moreover a tendency to recurrence is occasionally encountered, and, in one of my patients operated upon 9 years ago, recurrences of epididymitis still take place.

Acute epididymitis is not only a painful and distressing annoyance to a patient, but it lowers his general resistance, delays the healing of the tissues, necessitates the removal of an indwelling catheter, and compels the temporary cessation of any further urethral instrumentation. Though only in about 10 per cent of cases does it proceed to suppuration yet it is a potential cause of septicæmia or pyæmia, and its prevention is, therefore, extremely desirable.

Of the possible routes of infection from prostatic cavity to epididymis, although conveyance of organisms by the blood stream cannot be denied, and although, as some believe, the lymphatics of the cord may occasionally be concerned, yet in the vast majority the infection is undoubtedly carried along the vas deferens. Ligature of the vas, or better still section and ligature, can, therefore, be relied upon to prevent epididymitis provided that it be performed before the organisms have reached the epididymis. Murphy recognized this and whenever the history disclosed a former epididymitis, however mild, he always performed bilateral vasectomy as a preventive measure immediately prior to removing the prostate; he does not appear, however, to have adopted it as a routine procedure.

Proust, in his perineal operation routinely ligatured the vasa deferentia just above the prostate, and Albarran also ligatured the vas in either groin.

Since 1922, I have employed bilateral vasoligation routinely in all my prostatectomies, and my previous incidence of 22 per cent of epididymitis has completely disappeared—I have not met with a single case in 177 prostatectomies since adopting this preventive measure. I expose the vas on either side through a small incision in the groin, divide it between forceps, and ligature each end. This is done at the time of operation in a single stage prostatectomy, or at the first step of a two stage procedure. Sooner or later, one will assuredly come across a case where organisms have already reached the epididymis just prior to the vasoligation, so that epididymitis will occasionally occur in spite of this pro-

[1] Brit. J. Urol., 1929, March, 7.
[2] Brit. J. Urol., 1929, Sept., 285.
[3] Lancet, 1922, Feb. 18.
[4] J. Urol., xvi, 141.
[5] J. Urol., xix, p. 65.

cedure; so far, fortunately, I have not met with this. On a few occasions, however, the small wound in the groin, after having healed primarily has broken down and discharged for a few days, the infection having, obviously, travelled along the vas to the upper ligature, but having been prevented thereby from reaching the epididymis.

If, then, a timely vasoligation can prevent epididymitis, would it not be better to perform this at the earliest opportunity and thus avoid the possibility of pre-operative epididymitis—a condition at least as harmful as postoperative? For this reason Alyea[1] advocates the ligation of the vasa of all cases of prostatic obstruction on their admission to the wards. He accomplishes this without any anæsthesia, by a very simple "closed" technique, which he is satisfied leads to complete occlusion of the vas.

There can be no objection to vasoligation from the point of view of future sterility, since, in any event the patient after prostatectomy will almost certainly be sterile, though not necessarily impotent. Indeed, if there be any truth in Steinach's contention that vasoligation, by causing proliferation of the cells of Leydig and a greater output of testicular hormone leads to "rejuvenescence," then the patient will gain additional benefit.

Recurrence of prostatic hypertrophy. A rather disquieting feature in connection with prostatectomy and one which is becoming increasingly manifest is the possibility of a recurrence of the prostatic hypertrophy many years after successful operation, even though there has been complete relief in the intervening period. Several such cases have now been recorded by operators of considerable experience, where there can be no doubt but that the operation really was a "radical" enucleation, as proved by the preservation of the specimen thereat removed. There is no question of malignancy having supervened, and the recurrent prostate is, like the original, of the fibro-adenomatous type. Possibly the source from which the prostate has been regenerated lies in the compressed and atrophied gland tubules whose presence has been demonstrated microscopically, in fatal cases, in the wall of the cavity remaining after enucleation of the prostate. More probably, however, the new prostate arises from small adenomatous nodules that are not infrequently left behind during prostatectomy, and to prevent this the prostatic cavity should always be thoroughly searched for such remnants.

Time does not permit me to refer in detail to other interesting features of Murphy's work in urology: his emphatic caution against the performance of nephrectomy in renal sarcoma, based on his experience that recurrence in the opposite kidney inevitably follows; his "fist-percussion" test for tension within the renal capsule; his observation that when a kidney, the seat of neoplasm, is repeatedly palpated bimanually a trace of albumin and some red blood cells almost invariably appear in the urine—a test of especial value where previously there has been no urinary change; his insistence that in all plastic operations involving the urethra the urinary stream be diverted from the area of operation throughout the stage of healing; his advocacy of the free mobilization of the urethra prior to the resection of traumatic strictures; and many others.

I trust, however, that enough has been said to indicate that, as in other fields to which your previous orators have drawn attention, so in this field of urinary surgery Murphy held a foremost place and was, in many respects, a pioneer.

Let us then bestow all honor upon one whose breadth of vision and whose boundless energy were such as to enable him to enrich in so many directions and to such a profound extent that science and art which it is the prime purpose of this College to promote. And the honor that we confer is no mean honor, for to have one's life and work recalled and reviewed at each clinical congress of the American College of Surgeons—the largest in the world—is an honor that will last so long as your great Nation shall last, and that, my friends, gives every promise of being coeval with life upon our planet itself. Surely, then, to confer such an honor is to confer, in very truth, fame immortal.

[1] J. Urol., 1928, xix, 65.

THE PRESENT STATUS OF CARDIAC SURGERY[1]

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SURGERY of the heart must seem to some a singular topic to find its place in such an important meeting, especially since so few here can have any active interest in this field. At the same time, the American College of Surgeons is erected largely for its educational value and it may be that certain recent advances in this relatively unexplored field will create in some here tonight sufficient stimulation to enlarge the small group already actively engaged in attempting to extend the domain of surgery in this direction.

Cardiac surgery for our purposes may be divided into (1) the treatment of injuries of the heart, (2) the surgical treatment of acute and chronic pericarditis, (3) the surgical treatment of angina pectoris, and (4) the surgical treatment of mitral stenosis. I have let these divisions of this field follow one another in the order of their development. This order may also reflect their relative importance. Certainly, surgery is the only treatment for wounds of the heart, whereas there may be serious objection to the as yet unproved contention of those who support surgery as a means of therapy in mitral stenosis.

We cannot at this time discuss all the background upon which our present accomplishments rest, but it will not be amiss to point out that the surgeons in this special field owe a debt to all types of medical investigators. The steps which have led to a better understanding of the dangers of an open pneumothorax comprise but one phase of this problem, and the experiments of that inquisitive ophthalmologist, Becker, who, in 1872, was the first to create valvular insufficiency experimentally, put us under a special debt to the earliest of surgical specialties.

1. *The treatment of injuries of the heart and pericardium.* Surgical therapy in the general field of trauma needs no particular defense. It is the only treatment possible. In this special field, as in others, injury through its urgency has been the initial stimulus for surgery. Wars, if of no other use to man, have always carried forward this branch of medicine. Both Paré and Hunter owe a great debt to war, and there are many here to whom certain mysteries of our bodies were disclosed under the urgent stimulus of battle conditions. The initial information and stimulus obtained under field conditions needed great elaboration before surgical therapy, even in trauma, could be approved. This is seen in the hesitancy with which Larrey, in Napoleon's day, approached wounds that infected the pericardium. Anæsthesia had to be developed and technical surgery improved to a high degree. But the stimulus received in war soon reached to laboratories, and experimental endeavor readily showed how well the cardiac muscle would heal and how best to control the beating heart during suture. The final step in an understanding of this field came with the realization of the physiological effects of an increasing intrapericardial pressure. Riolan, in 1649, Morgagni, in 1761, and Jobert, in 1839, had described the dangers of an increased intrapericardial pressure, but it was not until 1884 that the investigations of Rose pointed out the great significance of this condition. Before cardiac tamponade was understood, cardiac surgery could not progress. Thus, in any case of a wound of the heart which can survive long enough to hope for medical care, the matter of chief importance is the intrapericardial condition. A wound of the heart due to a small pointed instrument, such as killed the Empress Elizabeth of Austria in 1898, becomes a serious condition because of the mounting intrapericardial pressure, as blood leaks from the ventricle but finds itself trapped in the pericardium. Once the intrapericardial pressure equals venous pressure, the heart fails to fill and its output is correspondingly endangered.

Wounds of the heart need immediate surgical attention, but the surgeon who would attempt repair must have a complete understanding of the condition he will encounter.

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12-16, 1931

Even in the most desperate cases he must be prepared for the almost immediate revival of a normally acting heart, once the intrapericardial pressure is relieved by a surgical opening. In the swirl of foaming blood he must accomplish closure of the opening into the heart without infringement of the coronary supply to the cardiac muscle or the flow of blood to and from the organ. Since complete anoxæmia is tolerated with safety for perhaps one minute, massive strangulation of the organ for the purpose of suture is contra-indicated. Methods for the exposure of the heart and the placement of such sutures as will be necessary without gross strangulation have been suggested from our clinical and laboratory experience. In brief this consists in the use of a stitch in the apex of the heart to deliver and hold the organ, and a finger on the opening to stay the loss of blood while control mattress sutures are placed which later approximate the opening until the final sutures are tied. Since any wound that the surgeon will see must of necessity be small, because the greater ones are immediately fatal, this latter method should suffice for the accomplishment of the ordeal without the loss of that equanimity so necessary in any serious surgical procedure.

Today the surgical treatment of wounds of the heart is the accepted therapy for this dilemma. In spite of the fact that no single surgeon can acquire great experience in this matter, the statistical study of results should give to the individual operator considerable confidence. The first attempted suture of a wound of the heart in a human being was by Cappelen of Christiania in 1895. Within 10 years a statistical study revealed 38.75 per cent recoveries in 160 cases. These figures have steadily improved. Tuffier, in 1920, compiled a total of 305 cases with 50.4 per cent recoveries. Ballance, in 1920, using only cases between 1912 and 1920, found 152 cases with 68.4 per cent recoveries. And in a study, made by us in 1926, of cases operated upon between 1920 and 1926 there were 28 cases with 78.6 per cent recoveries. Here then is a field for surgical endeavor in which the mortality is about 25 per cent. Moreover, this field not so long ago was considered beyond the limits of medical care. Perhaps this branch of cardiac surgery alone justifies the presentation of today.

2. *The surgical treatment of acute and chronic pericarditis.* This field for surgical endeavor is also an accepted one and has its natural dependency on the emergency surgery of trauma. Wounds involving the heart are in most cases infected, and it was natural that even the barber surgeons should have given them some care. It was only, however, after the real functions of the pericardium were unraveled by physiologists and pathologists that an intelligent, direct attack upon the disorders of this covering could be contemplated.

The surgical drainage of *acute pericarditis* needs no elaboration here. It is a simple procedure performed under local anæsthesia requiring usually the removal of one or more costal cartilages and depending largely for its success upon the dependency of the drainage. Studies made in our laboratory indicate that irrigation of the infected pericardial cavity with solutions other than physiological salt solution is undesirable. Dakin's solution in particular not only interferes with the conduction system but produces an adhesive pericarditis. Pericardiostomy should be carried out in all cases of suppurative pericarditis. The real problem here is our ability to make a proper diagnosis, and the statistics of Dr. E. A. Locke, who found that in 150 cases at the Boston City Hospital the diagnosis was made in only 17 per cent of the proved cases, are typical of the figures elsewhere.

Chronic pericarditis presents a much more interesting field. This condition has many variations, for the inflammatory reaction may be confined to the pericardial sac or involve the mediastinum and neighboring structures. In its most advanced form it glues the heart to the pericardium and this sac in turn to the bony cage. Thus, with each heart-beat the heart must move the thoracic wall or twist upon itself. In any degree of adhesive pericarditis the circulation is seriously interfered with, and in these cases the patients as a rule consult physicians with the ordinary complaints of those with circulatory failure. Here again our diagnostic acumen is challenged, for in the few cases submitted to surgery almost miraculous relief has been given.

Brauer, of Marburg, in 1902, led the arguments for the surgical relief of this condition and under his direction surgeons removed the overlying ribs which were impeding free cardiac motion. In some cases this simple procedure alone gave great improvement. But more elaborate study has shown that in many cases the cardiopericardial adhesions, often very dense and even filled with calcareous deposits, are more of a deterrent to the cardiac motion than the thoracic wall adhesions. As long ago as 1898, Delorme had suggested removal of the adherent pericardium itself. This operation of decortication of the heart is now an accepted procedure. It has been utilized and fully described in this country by my associate, Dr. C. S. Beck, and by Dr. E. D. Churchill of Boston. In my own clinic we have naturally an interest in this field and Dr. Beck has devoted a great deal of time in both the laboratory and clinic to this problem. His researches into the experimental production of adhesive pericarditis have conclusively shown that the Pick syndrome of polyserositis is produced in animals when an adherent pericardium is established. Moreover, the picture even of the thickened Glisson's capsule occurs in animals in which the condition is fully established. These studies also seem to indicate that the accumulation of fluid in either the thorax or the abdomen is dependent upon whether the right or left heart is impeded. This is a very important matter and explains certain clinical variations in the disease. Moreover, it suggests that proper clinical study may tell us just how widespread the disease is and upon which portion of the pericardium surgical attack should be aimed. Finally, it seems to be the opinion of those investigators and surgeons best qualified to speak upon this matter that the operation of decortication should be the operation of choice in almost all cases of adherent pericardium. Indeed, it would appear that the very simplicity of the Brauer operation of cardiolysis has deceived many and has failed to bring relief in cases where the operation of decortication would have yielded great relief. In addition, the Brauer operation tends to bring the heart into closer relation with atmospheric pressure which has been shown to be undesirable. These suggestions and this criticism of the Brauer operation are largely the results of Dr. Beck's experimental work and his careful clinical studies.

We have had the opportunity to see the brilliant results occurring from pericardiectomy: a bedridden, orthopnœic, waterlogged boy of 14 years restored to an active life. As I look back upon my short experience in medicine this case is today one of the most outstanding examples of the restorative powers of intelligent surgery.

3. *The surgical treatment of angina pectoris.* Surgical therapy in angina pectoris is based on the hypothesis that the stimuli which give rise to the symptom pain arise in the heart and are carried by some nervous pathway to the spinal nervous system where these impulses overflow and stimulate the somatic sensory neurons supplying the upper thorax, arms, and neck. The surgical act is aimed at division of this nervous arc, thus preventing the patient from recognizing the symptom pain. As the pathological condition which causes angina pectoris is still unknown, there is no intention of eradicating the disease by surgery. It is a method of treatment which is purely symptomatic, and therefore identical in purpose with the division of the sensory root to the gasserian ganglion in cases of trifacial neuralgia.

The operative treatment of angina pectoris was first proposed, in 1899, by François Franck. It was first practiced by Jonnesco, in 1916. The operation performed by Jonnesco was an elaborate procedure, consisting in complete removal of the upper three cervical ganglia and the first dorsal sympathetic ganglion on both sides. Chiefly because of the technical difficulties and in spite of the fact that Jonnesco's first case presented a most satisfactory result, the operative treatment of angina pectoris was not popularized. In 1923, Coffey and Brown, of San Francisco, claimed that their experience with 5 cases showed that removal merely of the superior cervical sympathetic ganglion or even division of the main branch from this ganglion to the heart sufficed to ameliorate the pain in cases of angina pectoris. The successful results reported by these investigators using such a

simple procedure led to a very general practice of surgical operations upon patients suffering with angina pectoris. Whether the procedures mentioned above or the many variations of them, or even the division of those branches from the vagus nerve thought to be the depressor nerve are of value in the treatment of angina pectoris is still under dispute.

In addition to these surgical procedures, there is the method of blocking the white rami at the point of emergence from the bony spine by the use of procaine or alcohol. This method, introduced by Mandl and Swetlow, has been ably defended and popularized by the work of Dr. James C. White, of Boston, and others. Its simplicity, in spite of the danger of the use of alcohol so close to the pleura and spinal cord, commends its trial, and the published figures seem to reveal results comparable to the more serious and cumbersome surgical methods.

The explanation of so many different procedures for the relief of a single condition bespeaks the difficulties which beset this special field. In general we may say that angina simplex, Heberden's angina, is a separate entity, not associated with coronary disease, and not functional. It is probably a disorder of the heart somewhat akin to vasospastic conditions elsewhere. It is probably, therefore, rare, and in studying the case reports one must try to judge comparable entities. Thus, the procedures outlined above could not, of course, be of benefit in coronary closure and it is the inclusion of such cases that makes comparable studies difficult. It is this outlook upon angina pectoris as a vasospastic condition that explains the relief reported by Coffey and Brown when performing removal of the superior cervical ganglion only. In this case they interrupted the motor control of a large enough area of coronary supply to prevent vasospasm. Thus the condition was prevented, not relieved.

But, if a widespread motor involvement is present, we know from the work of Cannon and his co-workers that a much more extensive procedure would be necessary since, even with both stellate ganglia removed, acceleration of the heart beat is possible. This function is lost in the cat when the rami of the upper nine dorsal nerves have been cut. If one is to look upon relief in these procedures as due to dividing the sensory arc, then an entirely different conception and act is necessary. The work of Ranson and Edgeworth has confirmed the original studies of Langley and Gaskell that the cervical sympathetic system has no sensory fibers above the middle cervical ganglion. It was this conception that prompted excision of the inferior, intermediate, and stellate ganglia. But Danielopolu and others have claimed (though the experimental findings of Cannon and ourselves controvert this) that removal of the main motor control may be dangerous. These views resulted in modification of the original ganglion excision procedures to division of the gray sensory rami only.

Even this brief discussion of the surgical methods proposed for the relief of angina pectoris will convince you of the tangled mass of evidence which confronts the student in this field. Somewhat over 500 cases are presented in the literature. Out of this list not more than 200 cases are worth critical study, and in relation to any single procedure the results are so few as to be unconvincing. It does seem certain that in many cases striking relief has been given sometimes by alcohol injection, and sometimes by the elaborate operation of removal of both complete cervical chains. In my own hands, in but a limited number of cases I have had somewhat better results with the complete cervical sympathetic chain extirpation. But I am not at all convinced that I am competent to inject the rami satisfactorily in all cases any more than I can promise success in relation to root injection in trifacial neuralgia. I believe that the whole problem merits further study, and until more accurate data with careful follow-up studies are available we should withhold any final condemnation or acceptance of one or the other method.

4. Finally we come to the *surgical treatment of mitral stenosis*. The relief of mitral stenosis by surgery is based upon the supposition that mitral insufficiency is more compatible with life than mitral stenosis. The idea is undoubtedly ancient, though it seems to have been first voiced by Samways, an

English veterinarian, who wrote in 1898 that "with the progress of cardiac surgery some of the severest forms of mitral stenosis will be relieved by lightly notching the mitral orifice." A few years later Sir Lauder Brunton urged his surgical colleagues to such an attempt. Sir D'Arcy Power, who is well known to many of you, was then Surgeon to St. Bartholomew's Hospital and he has told me of Brunton's convictions that the thing could be done, as well of the negative search by Arbuthnot Lane for a suitable case.

There is no time here to discuss the pros and cons of the assumption that in a patient the reduction of a stenosis would be beneficial. I must leave that to your medical philosophy. But it is fair to state that we had always the greatest fears that, even could this be done, the fact that the reduction would necessarily create a very abrupt change, rather than the slow adaptation of nature, might make such surgical attempts too dangerous.

My own thoughts in this direction date to the winter of 1916–17 when I was a volunteer worker in the Rockefeller Institute. The War interrupted direct efforts, but on our return to civil life Dr. Samuel Levine, of Boston, and I commenced experimental efforts in the Laboratory of Surgical Research at Harvard. There were many pitfalls and it was more than a year before I began to feel at all sure of our ability to operate within the thorax of animals. Once the difficulties of an open pneumothorax and satisfactory intratracheal anæsthesia were surmounted, there presented the difficulties of handling the heart for a deliberate procedure. The rough methods heretofore used of grasping the writhing organ for a rapid manipulation did not appeal to us, since even the temporary anoxæmia produced neurological changes such as to forbid its trial in human cases. Gradually a method was developed which allowed us to handle the heart without interfering with its blood supply and so to perform deliberate procedures with satisfactory hæmostasis, which method was described in relation to wounds of the heart.

After 2 years of experimental endeavor, the opportunity arrived to attempt reduction of the stenosed mitral valve in a girl of 11 years. The trials, tribulations, and great mental anguish of the responsibility assumed at that time are still very bright in my mind. This patient lived 4½ years and was undoubtedly better following the operation. How much of this benefit was due to the surgical enlargement of the orifice, how much to the change of the shape of the thorax, how much to better care, and how much to the fact that following the operation she went into slow fibrillation is difficult to judge. Autopsy proved that the orifice had been enlarged.

In this first case a knife was used, modified from a tenotome. Difficulty was experienced in cutting the thickened valve and this experience led us to a protracted study of the physical properties of the mitral stenotic orifice. Out of this study came the cardiovalvulotome—a cylindrical instrument working on the shearing principle which could cut the most calcified valve and would remove the specimen excised.

Since the first case we have carried out this procedure six times. No other case in our series has survived longer than 6 days. Meanwhile, other attempts have been made, one by Graham, in St. Louis, one by Pribram, in Germany, and one by Souttar, in London. Graham had an operative fatality, Pribram's case lived 6 days, and Souttar's case is still living. In our first 3 cases we used the simple knife, in the others the cardiovalvulotome. Pribram used our instrument. Souttar found the mitral orifice large enough to admit his finger; he operated from above and therefore did not carry out any intracardiac procedure.

In our own cases, we have experienced chief difficulty in locating the distorted mitral orifice from the ventricular side, and, though we prefer to approach from below and have full exposure, it may be that the simpler approach via the auricular appendix, where the funnel shaped valve will direct the instrument into the stenosed area, will eventually prove the more desirable method. In 2 cases in which considerable segments of the valve were removed, we felt that death was due to the fact that the small left ventricle could not handle the greatly increased amount of blood presented to it. In fact this sudden change may be one of the most serious objections to the operation as at present performed.

This is not the occasion to review all the problems presented by this new experience. Some are still under study in our laboratory, for what has thus far been done has not convinced us that the matter is as yet settled. Other cases have presented themselves that justify similar attempts, but until further information is gathered from laboratory data we feel that we should not continue our own attempts. No case, of course, will be a good risk, but when the young person with uncomplicated mitral stenosis reaches that point where life must be restricted to chair or bed, he or she is still in a condition in which this operation can be performed. That is seen in the fact that in our 7 cases only 1 died within 10 hours of the operation. It was the changes brought about by the operation that caused death, not the essential inability of the patient to go through the ordeal. Now that Powers has developed a method for the creation of mitral stenosis experimentally, it may be possible to determine the correctness of this hypothesis. Certainly, it is our hope that further experience will allow us to settle the many problems now awaiting solution.

This is, in brief, the present status of the surgery of the heart. The portals of this last domain have merely been opened. Within its limits are unexplored regions. The present accomplishments are meager in comparison with other fields for surgical endeavor, and there may be those here from whom further developments in enlarging this field will come. It would appear that, even if the therapeutical application of surgery be not extended, the advent of surgery into this field has been of much benefit. Certainly it has enlarged our physiological understandings of all that surrounds the function and action of our most vital organ. It has in particular stimulated investigation concerning the extrinsic innervation of the heart and the function of the pericardium. To one who has devoted particular effort to this field, it would appear that investigations concerning the disorders dependent upon a diseased pericardium hold for the moment the greatest promise of practical therapeutic value. This is so intimately concerned with anything which interferes with the return of blood to the heart that physiologists and surgeons will from now on find their circulatory problems a common one.

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THE OPERATIVE APPROACH TO THE HEART AND PERICARDIUM[1]

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IT is just 35 years since Sir Stephen Paget wrote: "Surgery of the heart has reached the limit set by nature to all surgery; no new method, and no new discovery can overcome the natural difficulties that attend a wound of the heart." In spite of this dictum by a master, it was in September of that same year, 1896, that Rehn (26) first successfully sutured a wound of the human heart.

The anatomy and physiology of the chest are so unlike that of the abdomen that for a long time men accustomed to abdominal surgery looked askance at the thorax. The bony chest wall is a barrier difficult to pass. The heart and pericardium, together with the large vessels at the base of the heart, give one pause; the minus pressure in the pleura and the sometimes alarming behavior of the heart and lungs when the pleura is opened, are disquieting factors; the disastrous results following on postoperative drainage of the freshly opened thorax are hard to forget; while the difficulty experienced in making a correct anatomical location of chest pathology has harassed the careful surgeon. All of these factors, together with some others, have slowed up the development of chest surgery. Certainly, an exploratory thoracotomy is hardly permissible except under unusual circumstances, and there is scarcely any operation so futile and damaging as hunting around in the thorax for pathology that had not been accurately located before operation.

In this paper we are concerned only with the operative approach to the heart and pericardium. Roughly, the different methods by which these structures may be reached by the surgeon fall into four groups, as follows: some one of the left lateral or parasternal routes which are usually ample in wounds of the left side of the heart, arrest of the heart and thrombosis of the pulmonary artery; the approach through the "triangle of safety" in draining an infected pericardium; central sternotomy in the surgical treatment of valvular disease, foreign bodies in the chambers of the heart or imbedded in the wall of the heart; and removal of considerable areas of the precordial bony chest wall for chronic pericarditis and cardiac hypertrophy.

Let us consider first the approach to the heart and pericardium when either or both of these structures are injured. Here tamponade of the heart by blood in the pericardial sac is the condition calling most urgently for relief. If there is a wide opening in the pericardium and a wound of the heart opening into one of its chambers, death from loss of blood will usually occur before the patient reaches a hospital. If the patient is still alive when seen, it is not the loss of blood itself that is doing the damage but pressure upon the heart by the blood trapped in the pericardial sac. The diagnosis of injured heart or pericardium is made from the location of the wound and the symptoms of heart tamponade.

Many of these wounds enter the chest to the left of the sternum. If this type of wound is present, the choice of operation is simple, because in left sided wounds of the chest, it is the left side of the heart that is apt to be injured and the left side of the heart is exposed quickly by one of the left parasternal approaches. There are a number of these. Until recently, the Kocher (5) method was one of the best known and most used, that is, by turning out a lateral flap composed of the entire thickness of the chest wall and including the third, fourth, fifth, and sixth cartilages. Burghard (5) modified this by raising the flap in two layers.

The Wilm's (5) operation is a long intercostal thoracotomy between the fourth and fifth ribs, with the use of a rib retractor. This is a very excellent approach in surgery of the lung, but it does not give a very good exposure of the heart. Lilienthal uses a long intercostal incision in the seventh interspace and widens the exposure with a rib retractor.

In addition to the flap and intercostal method there is a third parasternal approach

[1]Presented before the Clinical Congress of the American College of Surgeons New York October 12–16, 1931.

which has been much used. Here exposure is gotten by the removal of varying lengths of one or more ribs.

While these methods have been repeatedly used by the masters of surgery, the Spangaro approach seems the simplest, gives a good exposure, is quickly and easily made, and renders air-tight closure easy of accomplishment. While all of the features of this operation as now performed were not originally practiced by Spangaro, most of us agree with Cutler that Spangaro should be given credit for originating this method of reaching the heart.

The incision extends in the fourth interspace from the anterior axillary line to the margin of the sternum, where the sternal attachments of the third, fourth, fifth, and sixth cartilages are exposed and as many of them separated from the sternum as is necessary to give a good exposure. The exposure is much improved by a rib retractor and the one described by Lilienthal is best known to me. While the Spangaro operation is described as an intercostal approach in the fourth interspace, any interspace may be used that gives the best access to the site of that particular injury.

During the last 2 years 3 patients have been operated on for penetrating wound of the heart or pericardium in the University Hospital in Baltimore. Two of these were operated on by the resident surgeon at the time and one by myself. One was a penetrating wound of the left ventricle operated on by the resident (29). The left pleura was injured also. This patient died on the third day. An autopsy was permitted and death was found to be due to pneumonia of the left lung. There was little fluid in the pericardium and the wound in the heart was in good condition.

The second patient was operated on by myself. He was a young negro man who was brought into the accident room a few minutes before I was to operate on another patient before a group of students. The wound of entrance was in the third interspace just to the left of the sternum and was caused by a knife. The man was unconscious and pulseless at the wrist, but was breathing quite well. Listening over the heart disclosed weak and irregular movements, but no regular and sustained

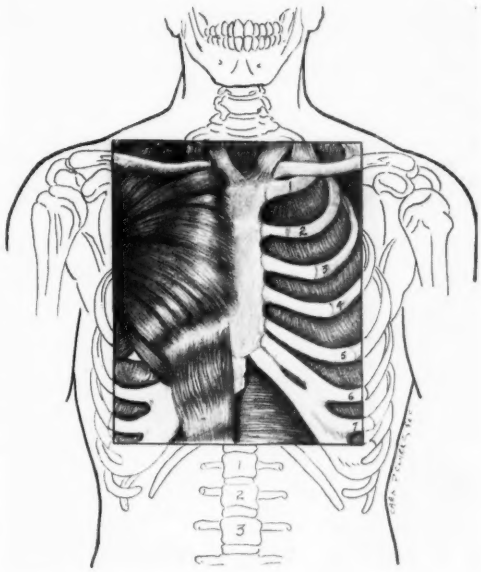

Fig. 1. Relationship of muscles, sternum, ribs, and cartilages in the average thorax.

pulsations were made out. He was brought directly into the operating room and hurriedly prepared. The operating room was already set up and the assistants were ready. The first part of the operation was done without an anæsthetic. An intercostal incision was made in the third interspace, the skin incision running also obliquely across the left half of the sternum. The cartilages of the third and fourth ribs were separated from the sternum, and the Lilienthal rib retractor was inserted. The internal mammary vessels were tied. The left pleura had been opened by the thrust of the knife and contained considerable blood and the left lung was partially collapsed. There was an opening in the pericardium high up on the left and at the level of the left auricle. The left margin of the sternum was in the way and a half-moon section of it was gouged away with large rongeur forceps. This combination approach gave a good exposure of the opening in the pericardium, which was distended and filled with blood. During this time there was little change in the patient's condition. He seemed in the act of dying, but continued to live. The opening in the pericardium was enlarged and several ounces of bright red blood escaped. There was no rapid gushing of blood, but a steady welling-up. Because of the nature of the bleeding, the left auricle was examined first and a small hole was found in the auricular appendage. This part of the auricular appendage was grasped with a curved clamp and held very gently while a silk ligature

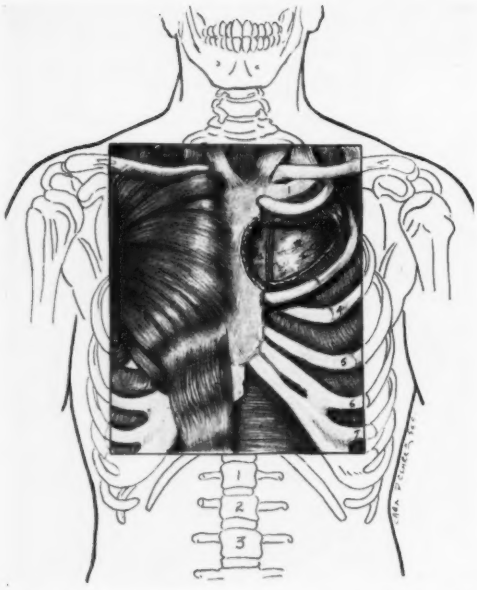

Fig. 2. Long intercostal incision with separation of the second and third cartilages from the sternum and removal of a portion of the sternum used by author in closing a stab wound of the left auricular appendage.

was tied around it in the way that a lateral ligature is put on a large vein.

As soon as the pericardial sac was emptied of blood, the heart began to beat strongly, but not very regularly at first, and the patient regained consciousness and began to struggle. He was anæsthetized with ether. The pericardium was closed loosely in order to allow escape of fluid, and the blood was aspirated from the pleura. The lung was expanded and an air-tight closure of the thorax was made. This patient recovered.

When one comes to close the wound the great advantage of the intercostal approach over resection of one or more ribs is at once apparent. It is not necessary to close the pleura by a separate suture. This is difficult in any case, as the pleura is very thin and tears and cuts through when sutured. The displaced ribs are pushed back into position and held there by throwing heavy interrupted catgut sutures around them and tying these sutures tightly enough to hold the two ribs immobile in their relation to one another, so that they move in unison with respiration. Because the distance between the ribs is somewhat lessened by the sutures, the cut edges of the pleura are in contact and soon unite. The muscle, subcutaneous tissues, and skin are closed in separate layers.

The third patient in this group was operated on by the resident surgeon for stab wound in the third intercostal space. The Spangaro approach was used and the internal mammary vessels found severed. They were ligated. There was a wound in the pleura and a small wound in the left side of the pericardium. Most of the bleeding came from the severed internal mammary vessels, because after these vessels were ligated and the blood sucked out of the pericardium and pleura there was no further bleeding. Both the pericardium and pleura were closed and an air-tight closure made of the chest wall. His recovery was uneventful.

The left parasternal approach is also used in operating for embolism of the pulmonary artery. Trendelenburg made an incision over the second rib 12 centimeters long and another incision parallel to the left edge of the sternum from the first to the third rib. He turned up two soft parts flaps and removed the second rib throughout the length of the incision and a shorter section of the third rib. He then ligated the internal mammary vessels and opened the left pleura, which was followed by collapse of the lung. He then opened the pericardium high up, being careful to stay in front of the phrenic nerve. This brings the pulmonary artery and aorta directly into view with the pulmonary artery to the left of the aorta. Trendelenburg and his associates operated on 12 patients by this route without a recovery. Kirschner, Meyer, Stegemann, Crafoord, Nystrom, Lake, DeHarven, all operated for pulmonary embolism by this approach. A number were careful not to open the pleura. Very gentle handling of the pleura in all operations in this neighborhood is essential. If it is already opened or has to be incised for any reason it should be protected and packed off by soft moist dressings. Carrel has laid especial emphasis on this precaution.

I have not operated for thrombosis of the pulmonary artery, but I believe the Spangaro approach would more quickly expose

this artery. Lockwood, however, speaking of the Trendelenburg method, says: "I have carried out the procedure repeatedly at autopsy. It is not at all a difficult feat."

Every operating room staff should be prepared to deal with arrest of the heart. This accident occurs frequently enough during the course of some operation or manipulation. In most instances after a short and very anxious interval, the heart begins to pulsate and in a short time goes on as if nothing had happened. This fortunate outcome may be helped along by sharp slapping of the chest, lowering of the head of the patient, and pulling forward of the tongue. Forceful pressure upon the precordial area with short and snappy release of pressure may aid in forcing some blood into the heart.

If, after a short interval, the heart is still not beating, cardiac massage offers the best chance of recovery. If either the abdomen or chest is open at the time, this maneuver is easy. The diaphragm is usually relaxed and it is not difficult to compress the heart between the hand invaginating the left diaphragm and the anterior chest wall.

We have had considerable experience with the treatment of heart arrest using these measures. Recently, while freeing a large tumor of the kidney by the transperitoneal route, pulsation in the aorta suddenly ceased. On palpating the heart, it was still. After compressing and releasing the heart between the hand and the chest wall by invaginating the diaphragm a number of times, there was a faint movement of the heart and some irregular beating and after a few minutes the pulse at the wrist returned.

If neither the chest nor abdomen is open at the moment of heart arrest, one has to decide quickly on the method of approach to the heart. The choice is between laparotomy and thoracotomy. The easier and quicker method is through an upper midline abdominal incision. If, for any reason, this approach is not feasible, then the chest should be opened by an intercostal incision, either the Spangaro operation or the Wilm's approach being used, as the heart can be exposed more quickly by either of these routes than by turning out a flap or by resecting ribs. The

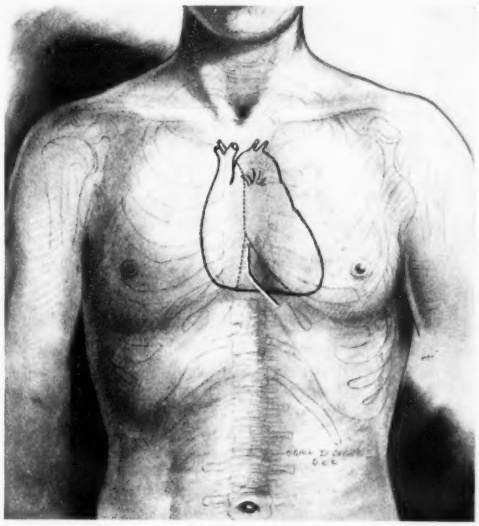

Fig. 3. Skin incision in the combined transsternal and transchondral approach in performing pericardiotomy for pyopericardium.

median approach through the sternum takes too much time. About 6 minutes is the usual limit, if consciousness is to return after the heart resumes its pulsations.

Pericardiotomy for suppurative pericarditis is worthy of careful consideration. Pyopericardium is much more prevalent than the reports would indicate.

There are four chief avenues of approach. All are based upon the "triangle of safety" of Voinitsch-Sionojentsky, which is a small triangular area uncovered by pleura situated in front of the pericardium. It begins at about the level of the anterior ends of the fourth ribs and extends downward to the diaphragm which, in the midline, is about behind the junction of the second portion of the sternum with the ensiform. This triangle has its apex up and base down and is just a little to the left of the midline. Its size will depend upon the size of the patient and the amount of bulging forward of the enlarged heart or distended pericardium.

Just to what extent the symptoms are due to heart tamponade and just how much to infection is sometimes difficult to estimate. There are three chief factors, tamponade of

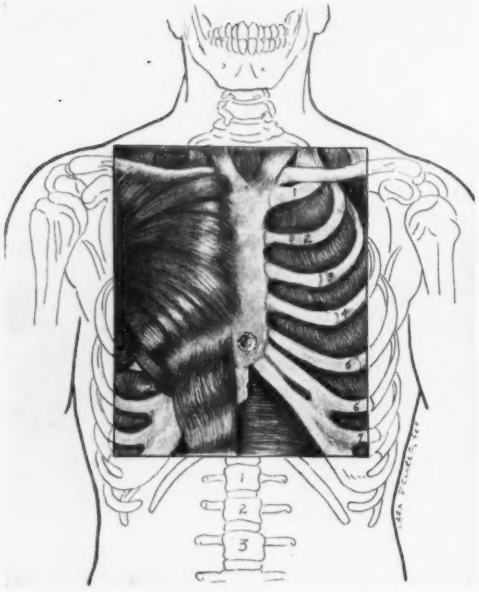

Fig. 4. Trephining of the sternum in the first stage of combined transsternal and transchondral approach in pericardiotomy.

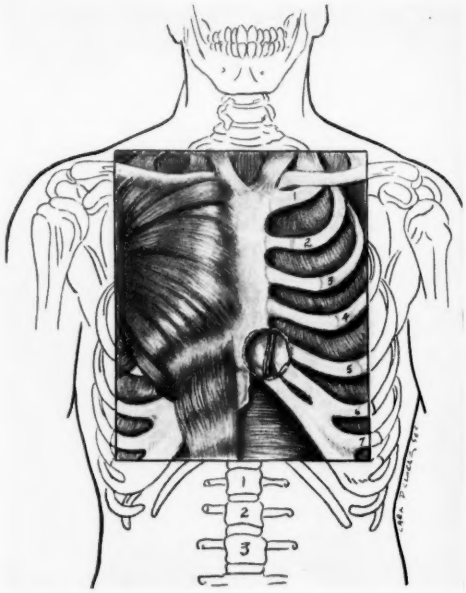

Fig. 5. Approach through the sternum enlarged by rongeur forceps exposing the uncovered portion of the pericardium.

the heart, infection of the pericardial chamber, and infection of other structures. Pyopericardium is apt to complicate an infection elsewhere, such as pneumonia, empyema, or osteomyelitis. If there is any considerable amount of pus within the pericardial sac, tamponade will be evident and the pericardium will be found enlarged by physical examination and roentgenogram.

Most of the fatal cases are either neglected cases of purulent effusion or are those cases complicated by serious infection elsewhere in the body. The last patient, on whom I operated, was a man who had been ill 4 weeks and who had a localized left sided empyema and purulent pericarditis and did not recover. The last case that I saw was a child 6 months old whom I saw for the first time just after it had died of a large purulent pericarditis in which the diagnosis had been made by looking at the X-ray plate a few minutes before. Aspiration of the pericardium after death confirmed the X-ray diagnosis.

Altogether, I have seen 12 patients with suppurative pericarditis and have operated on 11 of them with 6 recoveries and 5 deaths.

In 4 patients the transsternal route was used. This is a very simple and easy way to reach the pericardium, provided a number of factors are borne in mind. It is especially useful in operating on small children because the finger of the surgeon may be carried around the heart in order not to overlook pocketing of pus by fresh adhesions within the pericardium.

This approach was advised by Riolanus, in 1648, and in 1818 Skielderup repeated this suggestion. It was put in practice by Malle in 1855 who emptied a pericardial sac of blood by this method. Up to 1927, Dr. Nathan Winslow and myself could find only one pyopericardium drained in this way, that of Bexman, who operated in 1891 with recovery of his patient.

In adults, it is difficult to explore the pericardial sac with the finger inserted through a small trephine opening in the sternum so that in 5 of these patients the chondroxiphoid approach was used. This approach was described by Larrey, in 1829. An incision

Fig. 6. A new method of thoracotomy with beveled incision of sternum and intercostal incision through the first and sixth interspaces. (From Kerr and Warfield, Ann. Surg., 1928, lxxxviii, 620.)

is made over the seventh cartilage from its junction with the sternum downward and outward. The cartilages of the seventh, sixth, and sometimes the fifth ribs are cut away with a knife and rongeur, the knife being made to hug close to the sternum. In 2 patients a curved piece of the sternum was bitten away with rongeurs. This exposure brings into view the left margin of the pleura and the internal mammary vessels. Both may be pushed to the left, and the pericardium opened near the diaphragm. This approach allows ample space to palpate the inside of the pericardium.

In the 2 last patients, I have used a combination of both of these methods, which is more satisfactory than either, as it is quickly and easily made and has the advantages of both and the disadvantages of neither. The sternum is trephined just above the junction of the gladiolus with the ensiform and a little to the left of the center. This burr opening is then enlarged with rongeur forceps to the left until the lateral segment of the sternum and the ends of the fifth and sixth cartilages are cut away. This exposes the uncovered portion of the pericardium and the left margin of the pleura, and the internal mammary vessels hardly enter the field. It has the great advantage of bringing one down directly on the "triangle of safety" through a bloodless field and then enlarging the field as

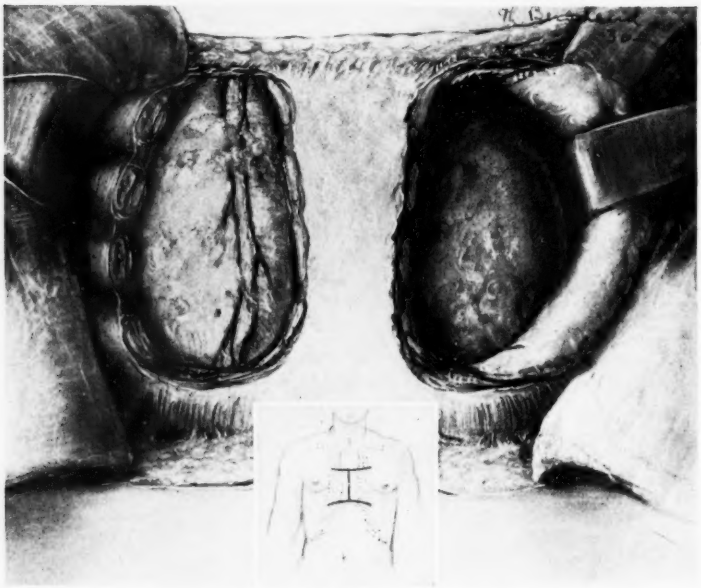

Fig. 7. A new exposure for resection of the pericardium. A wide exposure on each side of the heart is provided. (From Claude S. Beck, J. Am. M. Ass., 1931, September 19.)

much as is necessary to allow incision, examination, and drainage of the pericardium.

The pericardium can also be drained by a left or right parasternal approach. Either of these methods is satisfactory if the pericardial effusion is quite large; otherwise, there is considerable risk of opening the pleura.

By whatever route the uncovered pericardium is reached the next step is an anxious one. In my experience, no matter how much or how little fluid was afterward found in the pericardium, the anterior surface of the left ventricle near its tip was always felt tapping against the taut pericardium at each systole of the heart. In my first case I would not have opened the pericardium if the internist had not been present with pus in a test tube that he had gotten by paracentesis of the pericardium. One does not know how thick the pericardium is nor can one be certain that there are no adhesions between the heart and pericardium, so that cutting through the pericardium toward the tapping heart creates a feeling of anxiety and uncertainty. In order to make this step safer and easier I now grasp the pericardium with two Halstead forceps plicating some of the pericardial sac and then palpate and incise the plicated pericardium between these forceps, very much as some surgeons open the pleura or peritoneum.

When the pericardium is opened, there is a gush of fluid, sometimes frank pus, sometimes thin, purulent, cloudy, or blood-tinged fluid. In only one of my patients were any adhesions found, and this patient later developed a walling-off of pus lateral to the left auricle which necessitated a second operation.

As soon as the pericardium is opened, a very important factor immediately enters into the problem. In a report read before the American Association for Thoracic Surgery, in 1928, by Dr. Horine and myself (30), we made the following observation: "Because the pressure everywhere within the thorax, except in the lung itself, is lower than that of the atmosphere, one's curiosity is raised as to the effect of atmospheric pressure on the heart after pericardiotomy. Certainly, the func-

tion of the wall of the chest is to maintain a negative pressure within the thorax, and it is not unreasonable to suspect that the heart may be disturbed by exposure to atmospheric pressure. We believe that closed drainage of the pericardium in purulent pericarditis might lessen some of the imperfect results that follow on drainage."

In the *Archives of Surgery* for November, 1930, Beck and Cox (3) published the results of their experiments on the mechanics of the circulation following pericardiostomy. Their findings were definite, showed rise in venous pressure, fall in arterial pressure, decrease in minute volume output of the heart.

This work brings sharply to the attention of the medical profession again the old question that has been so much discussed, to wit: whether or not it is wise to subject intrathoracic organs to the pressure of the atmosphere while exposing them for operation.

Surgery of the valves of the heart, foreign bodies in the chambers of the heart, foreign bodies embedded in the heart muscles or any surgery involving either of the venæ cavæ, together with wounds of the right side or posterior surface of the heart, require good exposure and ample space in which to manipulate the heart.

The heart will tolerate considerable handling and may be elevated from its bed, the vessels at the base may be intermittently compressed, but it is hardly possible to rotate the heart to any extent, and for this reason it is almost impossible to bring the right side or posterior wall of the heart within reach of any sort of left sided approach unless a considerable portion of the sternum is removed.

The approach that meets these conditions best is the median sternotomy, known as the Duval-Barasty median thoraco-abdominal pericardiotomy. This approach was used by Cutler in his epoch making work on mitral stenosis. Matas reported three operations done by French surgeons for the removal of foreign bodies by this access to the heart. I have had no experience with it on the living patient, but in the dead house it gives a wonderful access to the heart and pericardium without injury to any large vessels and without opening either pleura.

It is a time-consuming procedure, however, both in entering the chest and in closing the wound. It opens two cavities, the abdominal and the thoracic, and in patients already handicapped by some serious heart ailment requiring operation, the time factor is important. It has two great advantages over any other approach in that it allows easy access to the posterior surface of the heart and does not open either pleura.

Kerr and Warfield in the *Annals of Surgery* for 1928 described a central lateral flap made up of one-half of the sternum and a portion of the chest wall. They used this approach in removing a dermoid of the mediastinum. It has the advantage of not opening the abdomen and it makes possible an easy airtight closure.

There is another group of heart and pericardial affections that is now attracting very considerable attention. The main consideration in this group is crippling of the heart because of adhesions in which the pericardium plays the major rôle.

Obviously, the pericardium may be firmly adherent to surrounding structures without much affecting the heart, unless there are adhesions fastening the heart to the pericardium. Many of the acquired displacements of the heart are due to this cause. In nearly every patient with unilateral fibroid phthisis, the heart is more or less displaced toward the diseased side because of these adhesions.

If the heart is adherent to the pericardium and the pericardium is not constricted or adherent to surrounding structures, it gets along very well in the majority of instances.

Of the 6 patients on whom I have operated for pyopericardium and who recovered, I have kept tract of 5 and no one of the 5 is disabled. Several had a slow recovery and one boy had anasarca and ascites with shortness of breath for several months, but now, after 5 years, is apparently well.

If the heart is adherent to the pericardium, which in turn is fastened to the unyielding chest wall, a condition of affairs may be created which led to the suggestion of Brauer that the bony chest wall be removed over the precordium so that the pericardium could follow the contracting heart during systole.

In 1928, Smith and Liggett reported 107 such operations collected from the literature. A number have been added since.

This operation has been given a number of names, but is usually spoken of as the cardiolysis of Brauer. It is a relatively simple procedure in which enough of the bony chest wall in the precordial area is removed in order to free the adherent pericardium. This same operative approach is used in decompression of the heart for hypertrophy where pericarditis plays no part. Morison proposed this in 1907 and Mr. E. C. Stabb operated on a youth 19 years of age. Evarts Graham discussed this operation in 1928 and in November, 1929, reported the cases of 2 children on whom he had decompressed the heart because of hypertrophy.

Recently, I used this same method of thoracic decompression in attempting to relieve the pressure symptoms in expanding aneurism in the upper thorax. In one instance the result was very striking. The patient was a negro man 32 years old with aneurism of the innominate artery. He was in great distress because of pressure within his thorax. He could not lie down and had great difficulty in breathing in any position. I saw him with Dr. Thomas R. Boggs at the City Hospitals, Baltimore.

The cartilages and the sternal ends of the right second, third, and fourth ribs, together with a portion of the right side of the sternum, were removed. The technique somewhat resembled that of a high anterior extrapleural thoracoplasty. The relief of the patient was very marked. He left the hospital in a short time much improved and quite comfortable. He died several months later following wiring of the aneurismal sac, which was done in another clinic.

If the chronic pericarditis is a constricting one, then a very serious condition is present, known as the Pick syndrome. It is difficult in many instances to know whether the chronic pericarditis is a constricting one or not. If the cardiac disability is due to constriction of the heart, then the simpler Brauer procedure will not suffice and the operation suggested by Delorme is indicated. Here it is essential that the pericardium and heart be well exposed in order that pericardiectomy can be carried out. Weill suggested the operation in 1895, Delorme urged it in 1898, and it was again referred to by Carl Beck in 1901, but it was not until 1913 that Rehn (27) reported his first case.

In 1929, Churchill reported a collection of 37 patients on whom pericardiectomy had been done. Nineteen did well, there were 7 operative deaths, 2 were not improved and 4 died later. In 5 patients, the operation was not completed. Volhard and Schmieden have reported the largest number, 7, which are included in Churchill's list.

There are three problems and all are important: the diagnosis, the exposure, and the removal of the constricting pericardium. It is with the exposure that we are concerned in this paper.

If the heart is to be freed a left sided parasternal approach is hardly ample. The Duval-Barasty combined thoraco-abdominal operation adds considerably to the shock.

Beck (2), in an excellent paper read before the Section on Surgery of the American Medical Association in June of 1931, discussed this subject, reported on the Pick syndrome from the experimental standpoint, and reported a recovery after pericardiectomy. The exposure was made by resecting the left third, fourth, fifth, and sixth costal cartilages and part of the sternum. He suggested a new approach to the pericardium and heart for pericardiectomy by a bilateral exposure gotten by resecting a part of the sternum and the cartilages of the third, fourth, fifth, and sixth ribs on both sides, thus bringing into view the entire heart. I have a letter from him dated September 19, 1931, in which he reports having operated successfully on a patient by this approach and that he knows of a patient operated on by another surgeon who got a satisfactory exposure by using this route in suturing a wound of the heart.

Evidence is accumulating that makes it incumbent upon us to distinguish clearly between the different phases of chronic pericarditis. There are four of these: adhesions between the pericardium and pleura; adhesions between the pericardium and heart—these two rarely call for surgery; adhesions be-

tween the heart, pericardium, and chest wall, which, if disabling, call for the Brauer operation; and constricting pericarditis, for which disabling disease pericardiectomy is indicated. Evidence is also accumulating that in the last condition surgical intervention should be considered seriously and operation, if it is to be helpful, requires ample exposure and careful freeing of the entire heart.

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SOME OLD TRUTHS ABOUT FRACTURES[1]

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THE object of the Clinical Congress of the American College of Surgeons is to increase the knowledge of the members of the College by intimate contact and the exchange of ideas. During your sojourn in New York, you are being shown and told many new ways and means of surgical treatment, new methods of diagnosis, new theories as to the causation of surgical conditions. I am sure that much of it will prove helpful to you in your thinking and in your practice. I trust that much of it will prove to be true.

Let me confess to you now, lest your disappointment be too great later on, that I have nothing new to offer you; hence the title I have selected "Some Old Truths About Fractures." My excuse for daring to come before you with such a paltry and time worn offering is that only too often the results of fracture treatment that we see among our own patients as well as those of our colleagues can be explained only by supposing that some of these old truths have either been forgotten or neglected. Our bad results are due more to neglect, procrastination, and carelessness than to ignorance. I, therefore, feel justified in discussing with you some of these old truths.

In fractures, the injury is not limited to bone. When due to direct violence there is contusion of the overlying parts. The ligaments and other supporting tissues of the adjacent joints are strained if not actually torn. The excessive muscular effort made in resisting the traumatizing force may injure tissue. When the force is sufficient to cause displacement of fragments, the sharp edges of the broken bone ends tear periosteum, overlying muscles, tendon sheaths, blood vessels, and nerves. There is local hæmorrhage from broken bone and from lacerated soft parts. In fractures, the injury is not limited to bone.

Proper first aid treatment should be taught in medical schools but of still greater importance is the education of the public. Most of the additional and quite unnecessary trauma occurs before the patient reaches medical aid. The surgeon may disclaim responsibility but it is his duty to try to teach the public. The value of early splintage was well proved by the British Medical Service when they sent the Thomas splint out with the stretcher bearers.

The injuries resulting from fractures are not limited to those occurring at the time of the accident. Unwise attempts to use the injured extremity may cause or increase displacement of fragments, increase the laceration of soft parts, and perhaps lead to penetration of the skin by ends of bone. The same additional trauma is often due to the awkward efforts of the bystander. A man is struck by an automobile, thus breaking his leg. Except for the broken bone, without displacement, the original injury may be merely slight periosteal tear and mild contusion of soft parts, but he is helped to his feet and the leg gives way, the fragments slide by each other, thus stripping off the periosteum and tearing the muscles. He falls to the ground only to be picked up and carried to the sidewalk, leg dangling. Larger blood vessels are torn, the bone end comes through the fascia, perhaps the skin, even the trouser. He is laid at rest with a coat beneath his head and surrounded by people anxious to help. Someone sees his leg is crooked and straightens it out. The exposed bone end re-enters the wound with a bit of trouser and the dirt of the street. Again, he is lifted up and carried to a car or ambulance. This time, someone carries the injured leg with better intentions than coordination and the ends of the bone are churned around in their bed of lacerated tissues and the contaminating organisms well disseminated throughout the area. During his ride, and in the transfer to the accident ward or the doctor's office, unless he has been carefully splinted, there is more jolting and more damage. Would that his troubles were over but too often the sad story continues. Lack of sufficient protection as he is lifted to and from the X-ray table and as he is being

[1]Oration on Fractures, presented before the Clinical Congress of the American College of Surgeons, New York, October 12–16, 1931.

anæsthetized, examinations which are too rough or extensive, or repeated, result in still more injury.

Compare this exaggerated picture with a similarly injured man who is allowed to remain where he is until a proper splint can be applied, or at least can have someone pull hard on his foot as he is being lifted and carried, whose examination is thoroughly but gently carried out, and whose treatment is instituted with but little additional injury. The difference in these 2 cases as regards time of disability and amount of permanent functional disturbance is tremendous.

Fractures are not always single. Although it was 20 years ago, I remember distinctly my sensations when I realized that a certain patient, who was recovering from a fractured skull, also had a dislocated elbow. Three weeks was too long a time to elapse before making a diagnosis. People often have multiple injuries. I blush to think of another instance when a man who had broken the shaft of his humerus told me 3 weeks later that he couldn't lift his wrist. My records did not show anything about this detail either before or after reduction and I wondered whether the nerve was hurt when he broke his arm, or whether it happened during my reduction, or whether it was involved later on in the callus formation. *Nerve injuries are sometimes associated with fractures.*

If we could only remember to investigate these matters! But having found what we consider the main lesion, our relief and satisfied curiosity only too often let us stop in our search for facts. Careless or hurried examinations lead us into trouble. And yet, the rough examination, the search for false point of motion and crepitus is, as we have said, accompanied by added injury and a greater problem of repair. The examination should be thorough enough to bring to light the necessary information but gentle enough to cause the least amount of additional injury.

Local reactions to injury begin immediately. In addition to the extravasation of blood into the tissues adjacent to the site of fracture, we find œdema developing within the hour. This adds to the swelling and impedes the circulation. The infiltrated muscular tissue shortens and its elasticity decreases, making reduction of displacements more and more difficult. Soon the blood clots and a fibrin network is formed to act as trellis for the new forming connective cells and new blood vessels. The rapidity with which the process of repair gets under way was not understood by that surgeon who is responsible for the old advice "wait 'till the swelling goes down" nor by those many authors and teachers who have handed it on down through the generations. This adage should be replaced by another:

Every fracture should be considered an emergency condition. A broken bone deserves as much consideration of the time element as a ruptured ulcer or an acute appendicitis. Every hour that goes by makes existing displacements more difficult to overcome. The recognition of the need for the early reduction of existing displacements has greatly reduced the time of disability and degree of permanent impairment of function.

The treatment of fractures should be based on a detailed consideration of the anatomy and pathology of each individual case. We are too prone to follow blindly set rules of procedure. We are too apt to say that a Colles fracture should be reduced by such and such manipulations. A certain form of splint should be applied. After so many days it is removed and the patient urged to resume use of his injured extremity. After a thorough examination and a careful study of the X-ray evidence, it should be possible to determine just what procedures are required to restore the fragments to their normal relationship, with the least additional injury. We should also decide by what method this reduction can best be maintained. The plan of campaign should be arranged to solve the problem of that particular case. These plans should include not only the method of reduction but also the method by which the bone fragments are to be maintained in their new position. Don't start the anæsthetic until all necessary preparations have been made and material assembled.

Reduction of displacements should be as gentle as possible. Displacement of fragments is due to the traumatizing force plus the pull

of contracting muscles. To obtain a gentle reduction, an anæsthetic is required to relax the muscles and force must be applied to restore normal relations. Unless this force is applied thoughtfully and carefully, unnecessary additional injury will result. Fragments often have to be disengaged, which may require an increase of the existing deformity. The basic element is usually traction in the axis of the extremity. This often must be aided or followed by lateral pressure to make the fragments engage, but lateral pressure applied before the fragments have been disengaged causes unnecessary injury to the bone ends. The results of our attempts must be checked immediately, first by clinical examination and then by X-ray.

The treatment of fractures subsequent to reduction is a double problem. The injured bone must be protected during the healing process lest the displacement recur. This means rest, relief from strain, immobilization. The injured soft parts must be restored to their normal state as quickly as possible. This means early functional activity and the various forms of physiotherapy. Above all, the circulation of the affected region must be maintained at its greatest efficiency. Methods aimed to protect the bone, delay the soft part recovery and interfere with circulation. Procedures directed toward the latter endanger the bone. The art of treating fractures lies in the adjustment of these opposing indications and in deciding how far we may safely risk one to benefit the other. Only the most general rules can be laid down. The details must be developed to meet individual conditions at each stage of repair.

Traction is most useful in the treatment of fractures. It is the basic principle in reducing displacements. It is also widely applicable in maintaining reduction. But some of the old principles are not understood or forgotten. Continuous traction remains effective only when sufficient countertraction is provided for. Many beautiful banjo splints are applied but the elastic pull is relaxed within 24 hours. In many Balkan frames, the patient slides down until the pull is relieved. The adoption of continuous traction as a means of reduction does not disbar other methods. If the overriding of a fractured femur is not overcome by traction within 24 to 48 hours it is better to try manipulation than to go on hoping in vain. Soon the callus formation will prevent reduction by any except open method. The amount of traction should be varied with its object. It takes 30 pounds to accomplish a reduction which can then be maintained by 10 pounds. The indication for traction in maintaining reduction is more frequent and more lasting in oblique fractures than in those which are transverse.

The dangers and difficulties of the open method of treatment are greater than those of the closed method. It should be adopted soberly, advisedly, and wisely, and only by those who are willing and able to develop and carry out the special technique involved. It is indicated only when the result, which can be justifiably expected, will be sufficiently better than that to be obtained by other methods, as to warrant the added risk.

The present situation of compensation machinery needs radical change. While it undoubtedly brings financial relief to many injured people who otherwise would be in dire straits, it also prolongs the period of disability for many far beyond what it should and could be. The condition called "compensitis" is often worse than the original injury. It is foolish to expect an individual's disability to stop until his compensation for that disability has been settled.

The general public is overoptimistic about the results of fractures. Their attitude toward the surgeon is much the same as it is toward the obstetrician. If things go well—why of course. But if the result is not perfect—it was the doctor's fault. They do not seem to realize that the original injury may have been too great for a good result. This attitude of mind seems to be especially prevalent among those who make up juries in damage suits. Let us hope that the American College of Surgeons can spread among the public not only gentleness in first aid treatment but broadmindedness in judging our results.

Success depends on intelligent co-operation. In few other fields of surgery is the partnership between surgeon and patient of more importance than in fractures. The surgeon

can do a good deal to help him get well but the result depends even more on the patient's bodily processes of repair and his voluntary acts of co-operation. We cannot do much to aid his process of repair but we can refrain from doing a great deal of harm. We can avoid much unnecessary additional trauma, interference with circulation, too long immobilization and other details. By patient explanation and drilling we can encourage him to carry on—not extensive movements three times a week, but gentle action every hour and in other ways to do his share of getting back to the nearest approach to normal and at the earliest moment circumstances permit. At the same time we can spare him undue disappointment and ourselves censure by trying to predict the probable outcome. Let us remember the old advice of William T. Bull, to his assistants: "Doctor, if you can't help, for God's sake don't hinder!"

DENERVATION OF THE ADRENAL GLANDS FOR NEUROCIRCULATORY ASTHENIA

Technique and Clinical Results[1]

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BASED on favorable results of experimental investigations of the adrenal-sympathetic system and on conclusions drawn from operations on the thyroid-sympathetic system in cases of hyperthyroidism, we have sought to control certain analogous energy-transforming diseases, particularly those due to pathological activity of the adrenal-sympathetic system. To this end, we have performed operations on the adrenal-sympathetic system in 126 cases. On this occasion, however, we shall report the results obtained in one group only, namely, cases of neurocirculatory asthenia.

In the war a certain number of officers and men became incapacitated during their service at the Front on account of a baffling disorder which was designated "soldier's heart," the principal features being rapid heart beat, nervousness, and fatigue. In the stress of civilian life there are seen many cases of this same condition which is usually given the descriptive name, "neurocirculatory asthenia." This disease resembles, and is often mistaken for mild hyperthyroidism, especially in those cases in which there is a goiter and a moderate increase in the basal rate.

Neurocirculatory asthenia is a pathological state in which there is an excessive stimulation of the adrenal-sympathetic system, and since other kinds of treatment have failed uniformly, we logically concluded that since hyperactivity of the thyroid—hyperthyroidism—could be reduced, then hyperactivity of the adrenals could likewise be reduced.

In association with Dr. E. P. McCullagh, a critical study has been made of the effects of certain operations on the adrenal gland and sympathetic nerves, the basis for these operations being, as stated, the conception that neurocirculatory asthenia is an example of pathological physiology, analogous to the conception that hyperthyroidism is an example of pathological physiology. Jonnesco, many years ago, resected the cervical-sympathetic ganglia for hyperthyroidism—an outstanding example of an attempt to modify pathological physiology. So too, an adrenalectomy performed by me 19 years ago, was an attempt to modify certain cases manifesting symptoms of pathological physiology, by surgery. Leriche, of France, Hunter and Royle, of Australia, Adson, Craig and Learmonth, and others are advancing this field of the surgical control of pathological physiology.

About 19 years ago, I first tested the effect of the removal of one adrenal gland in certain cases which manifested symptoms of pathological physiology, in some cases supplementing adrenalectomy by thyroidectomy and resection of the cervical sympathetic ganglia. The results gave promise, but in some cases the good effects tended to disappear in time, just as after unilateral thyroidectomy for hyperthyroidism the clinical results are good at first, then tend to disappear.

After following these patients for a period of years and undertaking new lines of investigation, it was found that a more effective procedure was bilateral denervation of the adrenal glands, the two denervations being separated by an interval of a week or more.

Since we consider that the adrenal glands constitute the power stations or brain of the sympathetic system, and that in neurocirculatory asthenia this power station is pathologically stimulated just as the sympathetic ganglia are too active in Raynaud's disease, we tested this conception by severing the nerves emerging from the adrenal glands.

Our first task was clearly to differentiate neurocirculatory asthenia from a group of diseases which present many symptoms in common. We clearly excluded the diseases analogous to neurocirculatory asthenia, the mechanism of which involves changes in the

[1] Presented before the Clinical Congress of the American College of Surgeons, New York, October 12-16, 1931.

action patterns in the brain. Among these excluded diseases are psychoneuroses, psychoses, neuroses, hysteria, maladjustments, in short all mental and psychic diseases. We thus limited our attack to that pathologically excessive activity of the adrenal-sympathetic system which produces a classical picture of abnormal nervous excitation, abnormal palpitation of the heart, abnormal nervous fatigue. The analogy to hyperthyroidism is at once apparent, since either the division of the sympathetic nerve supply to the thyroid, or of the adrenal nerves, profoundly modifies the hyperplasia of the thyroid gland, the metabolic rate, and all the symptoms of hyperthyroidism; while on the other hand, abnormal stimulation of the adrenal-sympathetic system easily reactivates the thyroid. That is to say, any one of the several links of the kinetic system may become the site of pathological physiology. This is especially true of the brain itself.

Theoretically, it is clear that pathological physiology of the brain can not be relieved by denervation of the adrenal nerves. We have tested this most important clinical point and have found that after adrenal denervation psycho-asthenia, psychoses, psychoneuroses, oddities of action patterns, and hysteria are not in the least benefited, just as these psychic and mental states are not benefited by thyroidectomy, by ganglionectomy, etc.

The theoretical and the practical indication for denervation of the adrenal glands is found in those individuals whose mental and psychic mechanism falls within normal range, but whose sympathetic system is under an otherwise uncontrollable stimulation analogous to that present in hyperthyroidism and in Raynaud's disease.

ANATOMY

The technique of adrenal denervation requires a precise knowledge of the anatomy of the adrenal glands especially in relation to their nerve and blood supply, and to their position with relation to other organs (Fig. 1).

The adrenal gland is a diminutive yellow pancake, golden in color, soft, friable, and vascular. As indicated by its name, it is situated adjacent to the upper posterolateral aspect of the kidney and always close to the vertebral column. An arrow piercing both adrenal glands would pass approximately through the center of gravity of the body. The gland is held in place by the strands of the sympathetic web, by the slender fibers from the neighboring fascial planes, and by its blood vessels. It is completely embedded in fat, and, on palpation, the adrenal border gives an impression unlike that of any other organ except the external ear to which it is similar in contour and motility.

The right adrenal gland lies in proximity to the diaphragm, the vena cava, the liver, the head of the pancreas, the duodenum, the kidney and the vertebral column. The left adrenal gland lies in proximity to the tail of the pancreas, the spleen, the aorta, the diaphragm, and the spinal column.

When the fascial sheet which binds the kidney to its halo of fat is opened, long blood vessels may be seen passing downward at the side of the kidney toward the vertebral column. These vessels are arrows which mark the trail to the adrenal gland. Generally there is an artery at the outer border of the adrenal and one also at the inner border, the largest artery being underneath, like the stem of a toadstool. From the adrenal glands thirty or more nerves emerge, and these are found on all aspects of the gland except the anterior surface where they appear at the borders.

In hyperthyroidism, the adrenal gland is greatly changed as to its vascularity, its adhesion to neighboring tissue, its appearance, and its texture, just as in hyperthyroidism the hyperplastic thyroid gland differs from the normal gland in respect to vascularity, adhesion, texture, and appearance.

In the course of manipulation incident to the exposure of all aspects of the adrenal gland and to the division of the nerves, oozing and sometimes smart bleeding are encountered. In no case, however, have we found it necessary to tie a vessel because, happily, in this deep operative field clotting is spontaneous. This may well be accounted for by the fact that adrenalin facilitates the clotting of the blood, as demonstrated by Cannon.

Many years ago in researches on blood pressure, I found that, during manipulation of the adrenal gland, an immediate rise in the

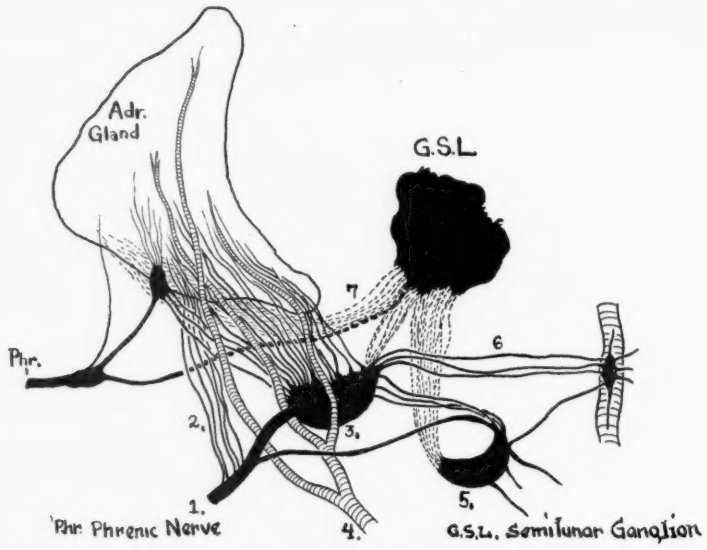

Fig. 1. The anatomy of the adrenal gland. *1*, Greater splanchnic; *2*, direct fibers of greater splanchnic going to adrenal gland; *3*, principal adrenal ganglion; *4*, inferior capsular artery; *5*, supernumerary ganglion; *6*, anastomosis of kidney and adrenal nerves. Note that the solid lines from *3* to the adrenal gland represent the main posterior pedicle. The dotted lines from *G. S. L.*, to the adrenal gland represent the secondary or internal pedicle. (Redrawn from Latarjet and Bertrand, Lyon chir., 1923, xx, 452.)

arterial blood pressure occurred and that immediately after manipulation the arterial blood pressure fell.

I found from these researches that the only gland or tissue in the splanchnic area, the manipulation of which caused a rise in blood pressure, was the adrenal. The manipulation of every other gland in the splanchnic area caused either a fall in blood pressure or produced no effect.

TECHNIQUE

Except in cases of high blood pressure, spinal anæsthesia is the method of choice for denervation of the adrenal glands, since it produces complete relaxation and lessens bleeding. The alternative to spinal anæsthesia is local and regional block anæsthesia combined with analgesia or with nitrous oxide or ethylene. If the operation is being performed under local and regional anæsthesia, then the adrenal glands, themselves, are blocked with novocain, since, although they lie among tissues which are only slightly sensitive to pain, they themselves are sensitive.

In several cases, with the patient in the prone position on the table, we have made the approach along the lumbar muscles through a vertical incision, believing that in this way we would approach the gland on its posterior aspect and by a shorter route. The special advantage of this method was that the nerves and blood vessels could be seen more directly, but the procedure had limitations due to the position of the patient on the table.

We have also made a vertical incision toward the anterior aspect of the adrenal along the tip of the twelfth rib but this method entailed too much contact with the peritoneum.

Recently, our method has been to make a modified kidney incision. This incision, running from behind forward, terminates at about the middle of the twelfth rib, and is then carried downward vertically (Fig. 2). The incision must be large enough to admit the hand into the renal space. Every bleeding point

must be securely tied before the deeper dissection is begun. Since good exposure is essential, by means of a right-angled retractor, the twelfth rib is raised and the bloodless field is disclosed. After the renal fascia has been adequately incised, a long vessel may be seen in the renal fat, the vessel which, as stated above, marks the trail to the adrenal gland. The first step is to mobilize the upper pole of the kidney and to depress the entire kidney when usually the yellow curved edge of the adrenal pancake may be seen. If the adrenal is not seen, the hand is introduced, and by palpation toward the vertebral column and the great abdominal vessels, the external ear-like border of the adrenal will be felt. At this point special instruments are introduced—namely, long, slender dissectors at one end of which is a dull dissecting blade and at the other end a blunt hook. In addition, we use a pair of blunt nerve hooks on a long shaft, a pair of French intestinal forceps, a tonsil dissecting knife, a fork retractor, and a pair of curved tonsil scissors (Fig. 3). These special instruments were constructed by Mr. V. B. Seitz, of the Cleveland Clinic.

The softness and brittleness of the gland precludes grasping it in an instrument in order to hold it and orientate its position and also, owing to the nerve and blood vessel attachments, the gland can be moved only within a very short radius. For these reasons the operation must be carried out essentially *in situ*.

After the gland has been exposed by separating the fat, the blood vessels are identified, and then, by means of the blunt nerve hooks, tonsil scissors and a long-handled tonsil knife, the nerves are divided. When this procedure has been completed, the adrenal gland will be quite mobile. It can then be raised up vertically from the vertebral column for a considerable distance.

Owing to the loose retroperitoneal tissue and the danger of oozing, we have usually inserted two cigarette drains, in the lumen of which iodoform gauze has been placed. The iodoform is used to prevent the contamination of the blood serum along the drains from a staphylococcus infection from the skin. The important point to remember is that, in approaching the glands, rigid attention should be paid to land marks and the operating field should be bloodless.

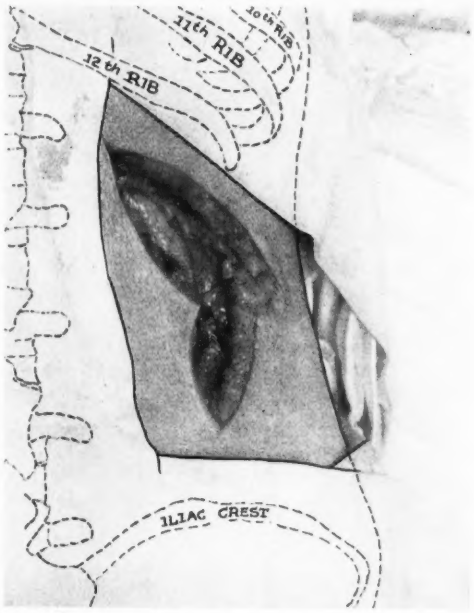

Fig. 2. Incision for denervation of the adrenal gland.

IMMEDIATE OPERATIVE RESULTS

Since the operation is performed in a territory of meager sensory innervation, and the blood loss is slight, there is but little shock. In 126 cases, there have been no deaths from anæsthesia, pneumonia, shock, or hæmorrhage. There have been two physiological deaths, but such deaths are now easily avoidable.

It is most important to state again that the clinical results in cases of diseases of mental or psychic origin, which may be confused with neurocirculatory asthenia, are negative. The differential diagnosis can be made with reasonable certainty by a careful history and physical examination.

The first point in the diagnosis is to make certain that the mental and psychic mechanism is normal. Then if an unstable heart is found, as manifested by tachycardia induced by trivial causes, or by no apparent cause such as by changing posture, by turning over in

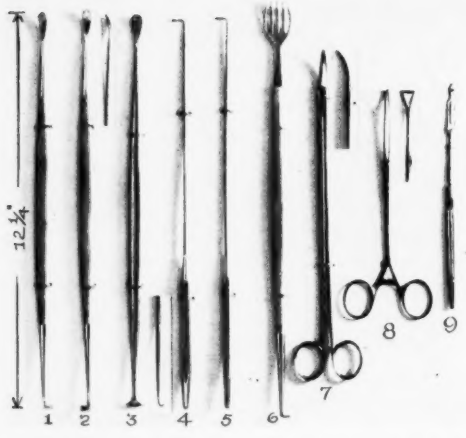

Fig. 3. Special instruments used for denervation of the adrenal gland: *1*, *2* and *3*, long, slender dissectors at one end of which is a dull dissecting blade and at the other end a blunt hook; *4* and *5*, pair of blunt nerve hooks on a long shaft; *6*, a fork retractor; *7*, pair of curved tonsil scissors; *8*, pair of French intestinal forceps; *9*, tonsil dissecting knife.

bed, by standing up, by slowing of the heart rate when the patient bends over, by any alterations in the heart beat up to and including paroxysmal tachycardia; if the pupils dilate as the result of pressure on the region of the epigastrium; if hippus, tremors, sweating and cold hands and feet are present, if there are unaccountable nervousness and tremors; if there are intermittent nervous excitation and fatigue; if infections and heart lesions are excluded, then the diagnosis of neurocirculatory asthenia may safely be made.

The heart can not initiate tachycardia, but tachycardia is imposed upon it so the sympathetic system can not initiate stimulation; stimulation is imposed upon it. Our purpose in these cases, therefore, is to interfere surgically with this pathological stimulation by denervating the adrenal glands, and we are finding the clinical results comparable to the results of thyroidectomy in cases of hyperthyroidism. So also "soldier's heart" could have been relieved by adrenal denervation.

The day following the first denervation the patient will notice a lessening of consciousness of his heart; he will experience a diminution of the feeling of nervous tension; he will observe a lessening of the cold sweat; a warming of the skin; and the nurse will notice that the patient is less restless—a sequence similar to that which is observed after thyroidectomy for hyperthyroidism. If the first denervation produces none of these beneficial results, it will be because the diagnosis is incorrect and the second denervation need not be performed. In correctly diagnosed cases, the second denervation will be followed by further improvement along the same lines, and the general improvement in cases continues steadily, just as in the cases of hyperthyroidism.

Among the inconstant but frequent results is the disappearance of constipation and indigestion.

END-RESULTS

As to the end-results in our cases, 1 patient has remained well for 14 years after unilateral adrenalectomy; 1 for 4½ years after unilateral denervation; and of the 21 cases of bilateral denervation performed within the past 18 months, 18 patients have remained well to date, in 2 cases the results are negative, and 1 patient we have been unable to trace. The final decision as to the potency of adrenal denervation must await the test of time.

A NEW METHOD OF OPERATING FOR THE REPAIR OF RUPTURED CRUCIATE LIGAMENTS OF THE KNEE JOINT[1]

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THE first attempt at repair of injuries to the cruciate ligaments was probably made by Hogarth Pringle, in 1907. The operation was next performed by Mayo Robson, and this procedure was reported later by Battle. The actual reconstruction of one of these ligaments was first undertaken by E. W. Hey Groves, of Bristol, England. In this first operation he utilized a band of fascia from the vastus lateralis, detached from its lower end, and passed it obliquely through the outer and posterior portion of the external condyle, obliquely down through the tibia in the direction of the normal anterior cruciate. He also suggested the use of the semitendinosus and gracilis tendons for the reconstruction of the posterior cruciate ligament. He suggested that these tendons should be carried through the posterior capsule and up through the anterior portion of the medial condyle.

Later Mr. Alwyn Smith suggested that the upper portion of the vastus lateralis should be detached and dissected down so that it could be carried through the lateral condyle, leaving it attached at its lower end. He opened the knee joint by making a split patella incision, then carried this new tendon obliquely down through the head of the tibia, and reflected the excess portion that extended below, back upon the collateral tibial ligament as an adjunct to the strength of this ligament. It was his opinion that the instability in knee joints in which the cruciates had been repaired was due to a laceration of the collateral tibial ligament and that by strengthening it he could avoid this instability.

We are not able to understand why there is such a marked increase in the motion of a knee joint in which there has been a traumatic rupture of the cruciate ligaments as contrasted with the very limited motion when these ligaments have been divided in experiments upon the cadaver. We have sought for clinical rupture of the collateral tibial and collateral fibular ligaments in about 200 severely injured knee joints, but as yet we have found no convincing evidence of the rupture of either one. In no instance have we been able to push the fingers between the condyles of the femur and the tuberosity of the tibia, and this would certainly be possible had there been a transverse laceration of either ligament. In one we thought there was a longitudinal separation of the fibers of the collateral tibial ligament, but in this case the skin over the supposed lesion was carefully dissected up and the ligament found intact, with no evidence of any rupture or detachment being present. In the joints that we have opened for ruptured crucial ligaments, we have not observed any detachment of these ligaments from either the condyles or the tuberosities, and yet there has been an enormous amount of anteroposterior and lateral motion in both joints. This is more markedly evident when the individual is completely anæsthetized. For these reasons we do not believe that the terminal portion of the fascial transplants reflected down upon the collateral tibial or collateral fibular ligaments will add very much strength to the joint. This was not done in either of our cases and yet the joints were very stable in spite of their marked lateral and anteroposterior motion before the operation.

A. H. Edwards, of Glasgow, reported in the *British Journal of Surgery*, 1926, an operation which he had worked out upon the cadaver, but which at that time had never been used upon the living. Mr. Edwards made a long, medial incision which at its lower end curved across the leg anterior and to the outer side just below the knee joint. The joint was laid open by cutting the lower end of the capsule in front and chiseling off the tibial tuberosity, so that the patella and the other tissues could be laid back, making a complete exposure of the knee joint. He was very careful to avoid

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12–16, 1931.

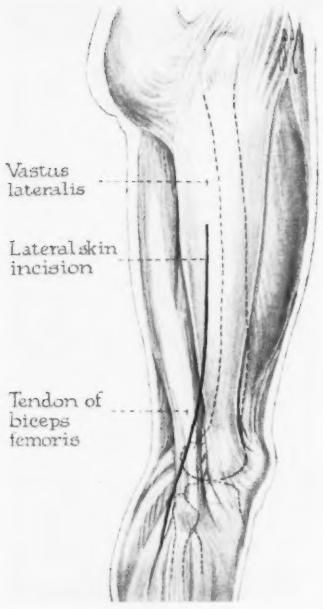

Fig. 1. View of thigh, showing bones and muscles in outline and line of incision. Aponeurosis and tendon of biceps femoris shown in white.

injury to the collateral tibial and collateral fibular ligaments. He then detached the tendons of the semitendinosus and gracilis from their distal insertion and dissected them up for about 10 inches on the inner side of the thigh, allowing them to retain their proximal attachments to the muscles. These tendons were now carried through a drill hole in the medial condyle of the femur, anterior to the tendon of the adductor magnus, into the intercondylar notch. An opening was now drilled from the anterior and under surface of the medial tuberosity up to the position occupied by the spines of the tibia; an opening was also drilled through from the outer side and below the lateral tuberosity into the same opening. One of these tendons was then carried through this opening in the head of the tibia and fastened down to the medial anterior surface of the tibia, and the other passed down to the lateral surface of the tibia, through the same opening, and both were sutured into the edges of the elevated periosteum.

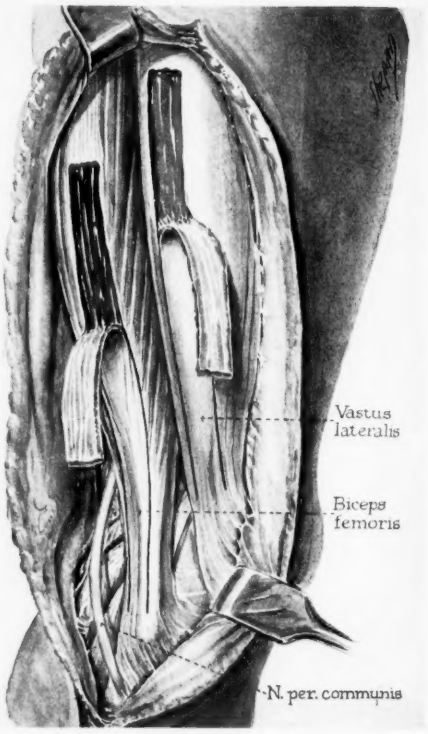

Fig. 2. Primary incision, beginning dissection of fascial strip from vastus lateralis and removal of aponeurosis from biceps femoris. Note width of fascial strips and points to which they are to be dissected.

In 1927, there appeared in SURGERY, GYNECOLOGY AND OBSTETRICS, an article by C. E. Eikenbary, of Seattle, Washington, in which he suggested that these ligaments be made from a tendon secured elsewhere, and that the entire operation be done through a long incision, median to, and parallel with, the patellar tendon. He accomplished this for the anterior ligament by drilling through the crest of the tibia upward, just in front of the anterior spine, and then drilling a hole through the head of the femur obliquely back and down, to emerge in the intercondylar notch on the medial surface of the lateral condyle. The new ligament was then passed through these openings and fixed by suture to the periosteum. The posterior ligament was made by drilling the hole in the crest of the

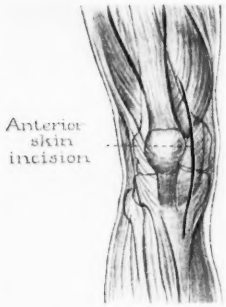

Fig. 3. Incision medial to side of patella. Anterior surface of knee joint.

tibia back and up, almost to the posterior edge of the tibia and then bringing this ligament back through a hole drilled just above the medial condyle. There is no report of this procedure having been tried upon the living.

In relation to these operations suggested by Edwards and Eikenbary, we are certain that they will not produce a lateral stability in the knee joint, because the tendons are situated in the middle of the joint, the proximal and distal ends not being far enough separated to insure a lateral or anteroposterior stabilization.

The next contribution was published by William E. Gallie and A. B. Le Mesurier, in the *Annals of Surgery*, of 1927. In this article they suggest an operation for the repair of the posterior cruciate ligament. Dr. Gallie's operation is very different from the preceding operations of Hey Groves and Edwards, particularly in that he does not detach the tibial tubercle and does not cut across the fascia of the anterior portion of the knee joint. He makes a long incision on the posterior surface of the thigh down to the upper portion of the calf. The tendon of the semitendinosus is exposed and isolated. It is then detached from the muscle as high in the thigh as possible and stripped downward to its distal insertion. The superficial portion of the split patella incision, which is used by this operator, is then made and the distal portion of the tendon grasped and pulled forward. A drill hole is now made through the tibial tuberosity into the popliteal space. The knee joint is then opened and this tendon

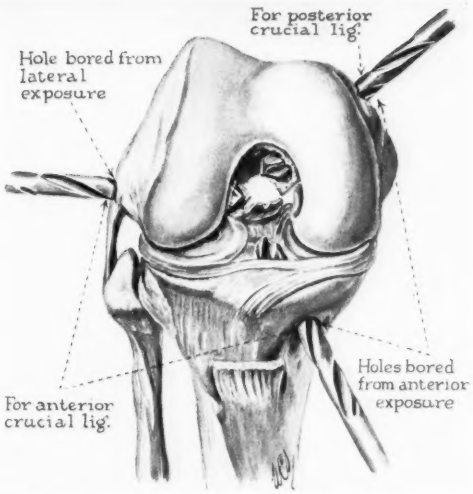

Fig. 4. The bones are shown in outline. Note the points at which the drills are inserted from without in.

carried up and back through the drill hole in the tibia to the popliteal space. From here it is passed forward through the posterior capsule into the joint. It is then brought out forward and through a drill hole in the anterior portion of the medial condyle. The joint is then straightened, and the excess of this tendon is carried out through the collateral tibial ligament and fastened on its surface in order to increase its strength. The split patella is then closed after the knee joint has been exposed a very short while.

We believe that this is a very excellent method of repairing the posterior cruciate ligament, but we do not believe that it is necessary to use it to reinforce the collateral tibial ligament; and we are sure that in some cases it may be a factor in limiting the flexion of the knee joint.

While we considered Gallie's method as an excellent procedure in the repair of this posterior ligament, we were a little hesitant about a deep dissection into the popliteal space and could not understand how we could use this method without either making two operations, or three incisions if we wished to repair both cruciate ligaments in one operation. It must be obvious that any operation which will reconstruct both ligaments at one

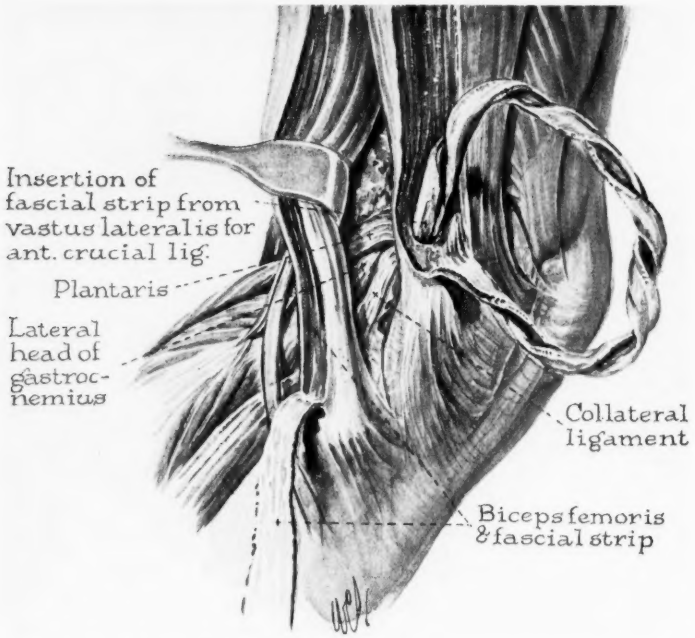
Insertion of fascial strip from vastus lateralis for ant. crucial lig.
Plantaris
Lateral head of gastroc-nemius
Collateral ligament
Biceps femoris & fascial strip

Fig. 5. Fascial strips have been dissected to their lowest points and the strip of fascia from vastus lateralis has been slightly twisted and drawn through the opening in the posterior portion of the lateral condyle.

sitting and thus avoid two separate surgical attacks upon the knee joint is the procedure to be desired.

In studying the anatomy in this region, we decided that the tendon and aponeurosis of the biceps (Fig. 1) could be utilized. It was dissected loose from a cadaver, its strength was carefully tested, and we found that it would sustain about 35 pounds dead weight. This was considered of sufficient strength to justify its use in the construction of the new posterior cruciate ligament. A strip of the fascia from the vastus lateralis taken from the posterolateral surface will sustain about 75 pounds dead weight. We found that both of these new ligaments could be obtained through a posterolateral incision 12 inches long (Fig. 2), extending from well above the middle of the thigh down over, and about 1 inch below, the head of the fibula. This approach also carries us to a point where both ligaments could be readily inserted into the knee joint, and these ligaments could be dissected loose and made ready for their new function before the knee joint was opened, thus shortening the time exposure of the joint.

The bicipital aponeurosis is dissected down off the muscle to the true tendon and about one-third of the true tendon is separated down to the head of the fibula. One must make this dissection very carefully to avoid injury to this new transplant, and a few muscle fibers will usually cling to the aponeurotic portion. Then a strip of the posterolateral portion of the vastus lateralis fascia about 1 inch wide is picked up and dissected down until it reaches that portion which is seen to curve slightly forward and anterior. This is exactly opposite the posterolateral portion of the lateral condyle, as is shown in Figure 2. These new ligaments should be about 10 inches long.

At this stage of the operation we can clip the edges of this wound together if we wish, or

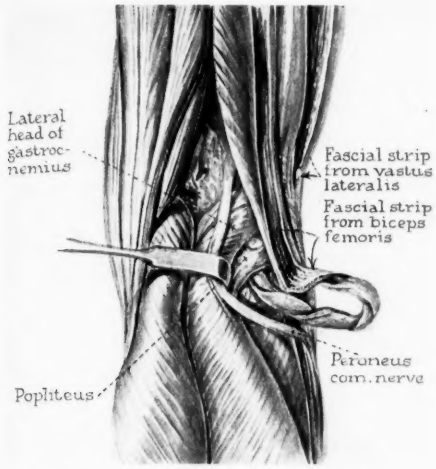

Fig. 6. Point at which the slightly twisted aponeurosis and tendon of the biceps are carried up beneath the popliteus and lateral to the outer head of the gastrocnemius and peroneus communis nerve.

merely cover with a towel and then open the knee joint through the incision shown in Figure 3. In those cases in which both of the cruciate ligaments have been ruptured, this incision will give a wide exposure, so that every anatomical detail of the joint can be carefully observed and any loose fragments of cartilage or injured menisci easily removed. In our cases, we were not able to see any remnants of the injured cruciate ligaments or any injury to the menisci. The condyles and tuberosities were widely separated, and a careful inspection could be made very quickly. These remnants had probably retracted down into the synovial sheath.

A three-eighth inch drill opening is now made through the medial condyle at its anterior and upper portion above the cartilaginous line, obliquely back and down to the upper portion of the intercondylar notch at a point where the anterior insertion of the posterior cruciate is normally situated (Fig. 4). Another drill hole is made in the medial surface of the medial tuberosity of the tibia, emerging in the upper surface of the tibia just in front of the anterior spine (Fig. 4).

The lateral incision is then opened and a hole is drilled through the posterior portion

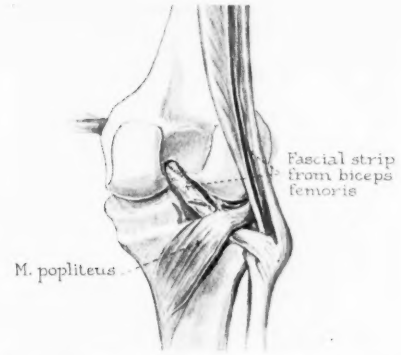

Fig. 7. The course of the new posterior cruciate ligament is shown in outline as it passes from the fibular head beneath the tendon of the popliteus muscle and medial to the curved inner portion of the lateral meniscus.

of the lateral condyle just above the collateral fibular ligament, extending transversely into the knee joint to enter the upper posterolateral portion of the intercondylar notch, at the point where the anterior cruciate originates (Fig. 4).

As you have noticed, all holes are drilled from without in and the drill will bring most of the débris out as it is retracted. If any free fragments are detached they are removed at once in order to avoid a free body that certainly would cause serious difficulty later.

In Figure 5 we see the fascial strip from the vastus lateralis, which is intended for the anterior cruciate ligament, being drawn through a hole in the lateral condyle just above the collateral fibular ligament. We also see to what point the tendon of the biceps has been dissected.

In Figure 6 we see how the tissue for the new posterior cruciate ligament is carried lateral to the head of the gastrocnemius and peroneus communis nerve, then beneath the tendon of the popliteus to where it is pushed through the posterior ligament of the knee joint just lateral to the oblique popliteal ligament and medial to the curved posterior border of the lateral meniscus, as shown in Figure 7.

If one will study the illustrated anatomies of the knee joint, he will observe just how the posterior portion of this posterior cruciate ligament extends down over the posterior

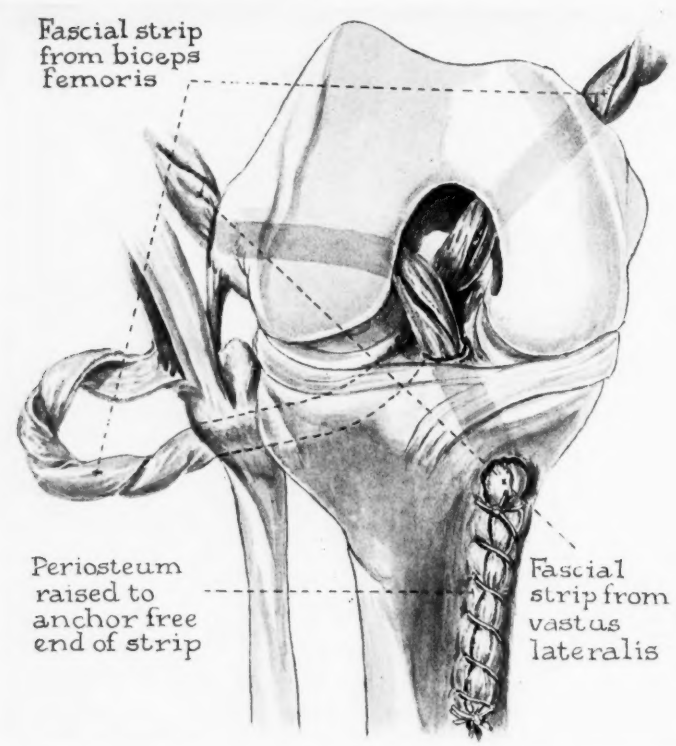

Fig. 8. A portion of the new anterior cruciate as it passes between the condyles, and the position where the new posterior cruciate is buried in the osteoperiosteal bed beneath the synovia.

border of the head of the tibia and this new posterior cruciate ligament arising from the head of the fibula follows the exact course of these fibers. Consequently this new posterior ligament should be able to meet the strain of normal knee joint action.

In Figure 8, we see these ligaments in outline and in particular we see that the anterior cruciate passes directly through the lateral condyle and then obliquely downward and forward through the head of the tibia. We are also able to note the oblique direction of the posterior cruciate as it is pulled up through the medial condyle, giving these ligaments their normal relationship.

An incision 2 inches long is now made through the synovia and periosteum of the femoral head, extended upward above the drill hole, and the periosteum dissected up in order to form a new bed for the attachment of the posterior ligament. A like incision is now made in the anteromedial surface of the tibia below the drill opening. The knee joint is now flexed about 25 degrees, the new ligaments are drawn taut and their terminal portions are sutured firmly into the new osteoperiosteal beds (Figs. 8 and 9). There should be only a slight twist in these ligaments, in fact just enough to prevent their fraying when they are drawn through the bony canal, because any marked twisting would interfere seriously with their nutrition.

We have made no attempt at covering these ligaments with synovia, as suggested and carried out by Dr. Gallie, because we are certain that if most of the synovial mem-

brane of a joint can be regenerated following its excision in the treatment of chronic arthritis, these ligaments will be covered with synovia at an early period. We are also sure that they will grow firmly into their new locations, both in the bony canal and in the osteoperiosteal beds into which they are buried. In one case which was done in two steps, the new anterior cruciate ligament which had been made 10 weeks previously was pink and healthy, and the wounds in the bone filled with firm fibrous tissue of obviously recent growth. This confirms the observations made by Gallie and his associates in their experiments upon animals.

We have not found any evidence in the literature that the aponeurosis and tendon of the biceps had been used previously in the reconstruction of these cruciate ligaments. The method of making the anterior cruciate is similar to that of Hey Groves and Alwyn Smith, with the exception that we do not imbricate it over the collateral tibial ligament. We did one operation in which we reconstructed both cruciate ligaments in one sitting and the knee joint is stable and strong, with a full range of motion. In another case we did the operation in two steps, making the anterior cruciate first and, about 10 weeks later, making the posterior, using the aponeurosis and tendon of the biceps muscle for the new ligament. This joint is also stable in spite of the fact that, to test its firmness, he removed the splint and walked upon the limb during the first 24 hours after operation.

It would be well to state here the effect upon the biceps muscle of having the aponeurosis removed. We have not opened any of these wounds; consequently, we have not had the opportunity to observe whether it would or would not regenerate. But there is no question that the muscle feels thinner and softer and that the sharp edge which is so easily palpable beneath the skin is nothing like so well marked. However, there has been no complaint as to either loss of strength or interference with function.

The preparation for these operations should be made with extreme care. Eighteen to 24 hours prior to the operation the limb is shaved to the buttocks, scrubbed with soap and water, washed with 60 per cent alcohol, and dry sterile dressings are applied. When the patient is anæsthetized, a Martin bandage is applied, extending from the toes up to the top of the thigh. Then a very strong tourniquet of some type is applied, and the Martin bandage is removed from the lower portion of the limb, thus leaving it almost bloodless.

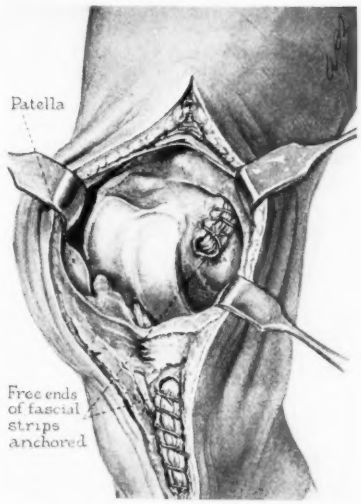

Fig. 9. The tendons in outline and their relations in the intercondylar notch. Note how the terminal portion of the new tendon is buried in the osteoperiosteal bed.

The lateral incision, as already stated, is made first. The gaping mouths of blood vessels are easily visible and are clamped and tied with very fine plain catgut. As a rule there are only two locations where these are found; they are the peri-articular vessels above the condyles and opposite the articulation on the inner side of the knee joint.

In closing the wounds, we have deviated materially from the standard used by many orthopedic surgeons, in that we have avoided a complete water-tight closure. The capsule and synovia of the knee joint are closed from above down with a continuous stitch, until we arrive opposite the articulation. Here a space of about 1 to 1½ inches long is allowed to remain open, so that the extravasated blood and synovia can escape from the knee joint. The skin is closed with Michel clips, spaced about seven-eighths of an inch apart. This

spacing of the Michel clips does not interfere with the extravasation of the fluid. When the dressings have been applied the tourniquet is removed.

The limb is supported in an angle of 25 degrees of flexion, with a long posterolateral molded splint of plaster-of-Paris, and the entire mass is placed in a curved Thomas splint, which is supported from a Balkan frame about 14 inches above the bed.

Dressings are changed at the end of the first 6 hours. In our experience with these and other knee joint operations, we have found that only three changes of dressings were required in the first 48 hours. The third change usually finds the dressings almost dry, and after that they are allowed to remain *in situ* until the clips are removed on the eighth day. No washing or cleansing of the wounds is done. Dry sterile dressings are applied with forceps.

At the end of about 4 weeks the cast is removed, and the limb is placed in a straight angle in a Thomas splint. Passive motions are now begun, and at the end of 6 weeks active motions are allowed. We have permitted no attempts at walking until about 14 weeks have elapsed. Then, if the patient is able to buy a brace for the knee joint we believe it to be advisable, as it would be excellent protection against an accident and stretching of the new ligaments. In our cases this was not possible but, in spite of this, both knee joints are strong and serviceable. They are not perfect, but the individuals are able to use them in a satisfactory manner, and they are very much pleased with the results. There is a slight lateral motion of the extended leg and a little excess of anteroposterior motion, with the limb flexed, but this increase in motion apparently causes no disability. When it is understood that these joints were utterly useless previous to the operation, it seems to us that these results should be considered a great victory.

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SOME EXPERIENCES IN THE TREATMENT OF CARCINOMA OF THE RECTUM WITH RADIUM[1]

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DURING the past 7 years I have endeavored to assess the value of radium as an adjunct to, or substitute for, surgery in cases of carcinoma of the rectum. In this period I have made over 200 applications of radium employing various methods described elsewhere.[2]

I endeavor to secure a uniform barrage of both the growth and the lines of lymphatic spread with the aid of surgery. In the time at my disposal it is not possible to consider either methods of approach or the very important details of dose, filtration, and length of exposure. Success depends almost entirely on uniform irradiation and a correct assessment of the optimum dose, which means a proper adjustment of three factors, radium quantity, time, and filtration. Given the optimum dose, success can only follow if the entire growth is attacked in a uniform manner and lymphatic spread is prevented. It is, therefore, apparent that there are many loopholes for failure. Only by prolonged experience can one hope to be able to prescribe the correct dose and the ideal method of application for any individual case. I recognize that I stand only on the threshold of this problem. In matters surgical we have behind us the accumulated experiences of generations of surgeons; it must be many years before we learn through the experience of others to standardize our technique in radium therapy.

At the present time the difficulties associated with the irradiation of carcinoma of the rectum are so great that it is impossible to appraise its value without much more experience than I have been able to get. Nevertheless I will try here to convey my impressions of its value as a method of treatment.

RADIUM FOR OPERABLE GROWTHS

I am satisfied that, with our present knowledge, the results of treatment are too uncertain to justify the use of radium as a routine measure in preference to radical surgery in *those cases in which there is a reasonable prospect of successful radical surgery*. It is a tempting proposition to endeavor to remove an early rectal growth with the aid of radium, to leave an intact rectum with normal function, and to avoid a colostomy. We can attack the tongue in this way, and be confident of a cure in a large percentage of cases, but we cannot control or stop lymphatic spread without the aid of surgery in most instances.

In cancer of the rectum, lymphatic spread does not occur until the growth has penetrated through the muscular wall of the rectum, and if often happens that the lymphatics are found to contain no metastases even though the growth has invaded the perirectal tissues.

Consequently, if the rectal growth responds well to radium the chances of cure are better than in the case of the tongue. Unfortunately, adenocarcinoma is more radioresistant than squamous carcinoma. Although just as the more malignant grades of squamous carcinoma are more radiosensitive so I think it will turn out that the more malignant grades of adenocarcinoma are more sensitive to radium. More observations on this point, however, are required. The grading of this type of growth is not easy as different areas of the same growth when examined histologically sometimes fall into different grades.

The rectum is at a great disadvantage when compared with the tongue because the exposure necessary for an accurate barrage is more often than not extremely difficult to secure. In the early days of radium therapy the method of approach to the rectum was by means of a tube containing radium in bulk, which was inserted into the lumen of the rectum and which usually was insufficiently filtered to cut out the bulk of the β-rays. It was seldom if ever possible by this method to give uniform irradiation to a rectal growth

[2]Brit. J. Surg., 1930, xvii, 68.

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12-16, 1931.

and the patients often suffered severely from radium burns, which increased their distress and did not cure their cancers.

In those cases in which benefit resulted, and some instances of cures by this method have been recorded, it is possible that cure resulted from necrosis following radium burn, just as it has done in some instances when the diathermic cautery has been employed. Nowadays, in early cases, with the aid of the surgery of access, uniform irradiation can be secured. If the growth is mobile, small, and not ulcerated, it is almost certain that lymphatic spread can be ruled out.

In a certain percentage of such cases but not in all, a correct assessment of the dosage factors will result in destruction of the growth and leave a healthy rectum, without the necessity of a permanent colostomy.

Some cases of adenocarcinoma are markedly radioresistant. In two apparently similar cases, one may prove to be radiosensitive and the other radioresistant though the treatment is identical. In some cases excessive fibrosis, cicatricial contraction and stricture will follow and render colostomy necessary. The degree of fibrosis is to some extent dependent on the size of the area treated, and the larger the growth the greater the risk of stricture.

It is, however, my belief that if we secure the optimum dose excessive fibrosis does not occur and a normal appearance with normal function follows. A few of my cases have borne this out. I might mention 1 case in which a small growth on the anterior wall of the rectum was treated by vaginal interstitial radiation after preliminary colostomy, with excellent results. A year and 9 months later the patient died from secondary hæmorrhage after closure of the colostomy. It was clear that the lumen of the rectum had been restored to normal caliber. New epithelium had grown over the scar. No trace of carcinoma could be found in the wall or outside the rectum after careful histological examination.

In spite of the fact that brilliant results can be secured *in early cases*, surgical excision with colostomy must be recommended in preference, because too often it happens that these brilliant results are followed by local recurrence. Only when radical surgery is contra-indicated on general grounds, or the patient refuses to submit to colostomy and excision, is it as justifiable to employ radium.

It is a matter of some interest to consider why, after an apparent cure, recurrence occurs. Is it because some stray carcinoma cells have been imprisoned rather than executed and awake to activity with the appropriate stimulus? Or is the return of cancer not in fact a recurrence but a re-development of cancer in an epithelial area which has shown a tendency to produce cancer?

Experimental work on mice[1] supports the view that recurrence after a local excision or destruction of a growth with radium is not necessarily due to incomplete removal or incomplete destruction, but may be a fresh outbreak of carcinoma made possible by the removal of "inhibition" exerted by the first growth on a potentially malignant area. This case is of some interest in this connection:

A woman aged 50 years was seen with an early mobile growth 2 inches in diameter on the anterior wall of the rectum. She was anxious to avoid a permanent colostomy and excision. A temporary colostomy was performed and the growth excised, with a free margin after posterior proctotomy. The rectum was restored to normal and the colostomy closed. Five months later a small new growth appeared at the anal margin where the spincter had been incised and a small recurrence the size of a pea was noted in the region of the original growth. Biopsy showed that both these growths were adenocarcinomata. They were treated by interstitial radiation with needles, and the rectum was again restored to normal.

Four months later the anal area remained normal but a small growth appeared at the old site, which proved to be malignant (Grade 2). Colostomy and perineal excision was then advised and carried out.

The history of this case suggests that the rectum had a high potentiality for malignancy, and that perhaps the removal of one growth stimulated further activity so that neither local resection nor radium could avail. Following the radium treatment, the histological grade of malignancy was reduced.

The growth which occurred in the proctotomy scar may have been caused by implantation at the first operation.

RADIUM FOR INOPERABLE GROWTHS

The treatment of rectal carcinoma with radium when too advanced for radical surgery

[1] Cramer, W Brit. J. Exper. Path., 1929, 335.

Fig. 1, left. Case of M. A. M., aged 69 years. Small operable growth was situated in the posterior wall of the rectum 1½ inches from the anal margin. No cystostomy was performed. On May 27, 1929, radon seeds were inserted intrarectally—8 seeds at 2 millicuries. A dosage of 1,729 milligram hours being given. Section of growth showed columnar cell carcinoma.

Fig. 2. W. S., aged 40 years. A fixed inoperable growth was located 2 inches from the anal margin, and completely surrounded the bowel. On March 25, 1929, colostomy was done and 5 radon seeds were applied to mesorectum and 5 to the growth per rectum, a total dosage of 3,325 milligram hours being given. On July 1, 1929, 6 radium needles, 2 milligrams, were inserted into growth per rectum (evenly distributed) and a dosage of 1,956 milligram hours was given. Section shows columnar cell carcinoma.

deserves consideration. Injudicious treatment of this class of case may do more harm than good. On the other hand it is sometimes possible to produce such improvement that the growth shrinks and ceases to be fixed to surrounding structures and is converted from an inoperable into an operable growth.

On three occasions I have carried out successful excisions in cases regarded as inoperable before radiation treatment. Very advanced cases with perirectal infection are unsuitable for radium.

Many inoperable cases have been treated after preliminary colostomy. When response is good the growth is largely replaced by fibrous tissue. Cicatricial contraction follows and ultimately fibrous stricture. Such a case as this may remain quiescent for many years and the patient remain free from symptoms.

In other instances of advanced cancer in which there is no hope of rendering the case operable or converting an active cancer into a quiescent fibrous stricture, radium has been employed in a less radical manner to relieve excessive discharge, discomfort, and pain by intrarectal application of radon seeds, thus avoiding all surgery which might aggravate the disease or excite sepsis.

The younger the patient and the higher the grade of malignancy the more rapid is the growth. Metastasis occurs early and operative prognosis is bad except in the very early stages. These cases usually respond well to radium, and if regarded as too advanced for excision are not altogether without hope, if radium treatment is prompt and thorough. I can instance a few cases to support this view.

Speaking broadly, the best field for radium in the light of our present knowledge is the conversion of a fixed inoperable growth into a less fixed growth which becomes suitable for radical excision.

Perineal recurrence following the modern method of excision is not very frequent. Such cases are usually beyond surgical aid. I have been able, in a few instances, to check the disease by destroying the recurrence. One of these patients is carrying on 2 years after irradiation and 6 years after excision.

ABDOMINAL RADIATION

When a rectal carcinoma extends above the peritoneal reflexion, it cannot be treated from below. I have treated a number of cases by transperitoneal attack, and the first case treated in this way nearly 4 years ago remains well and free from evidences of growth, and is without colostomy.

Fig. 3. The appearance of an anal epithelioma in a man aged 71 years, 3 weeks after interstitial radiation.

The growth was situated at the pelvirectal junction and was fixed to the sacrum, with adhesions to the bladder. Unfortunately, I have not been able to repeat this success. An initial success so striking is not easy to explain in the light of subsequent failures.

There are certain definite dangers. There is a risk of leakage from perforation through penetration of the lumen with needles. A certain amount of plastic peritonitis with effusion results from the irradiation and serious trouble may arise if drainage is inadequate. Later on I have experienced trouble from adhesions; intestinal obstruction has been caused by adhesions of the small intestine to the radiated area.

In some instances very marked improvement has followed without complete retrogression. At the present time, I do not use radium within the abdomen to attack the growth, unless radical surgery is ruled out. I have found it advisable to isolate the radiated area with rubber tissue to allow free drainage, to perform a colostomy but to avoid opening it if possible until the radium has been removed, if needles are used. If radon seeds are used they may be left in; the difficulties and dangers are diminished but the absence of a constant radiation seems to be less effective.

Fig. 4. H. C., aged 73 years. End-result of irradiation (interstitial needles) for epithelioma of the anus, 21 months after treatment.

RADIUM ASSOCIATED WITH RADICAL SURGERY

There is another field for the use of radium; that is in conjunction with radical surgery.

In most instances when I open the abdomen to explore and to carry out colostomy as a preliminary to excision, I employ radon seeds to barrage the lines of lymphatic spread upward along the superior mesenteric vessels. The seeds are inserted beneath the peritoneum and no drainage is required.

It will be many years before the value of this procedure can be assessed in the follow-up of excision cases. One case suggests that this procedure is of considerable value.

In the case of an advanced growth in a young woman, at the time of laparotomy, several enlarged glands were noted along the superior hæmorrhoidal vessels. These glands were irradiated with radon seeds inserted directly into the glands. One gland was removed for biopsy and found to be infiltrated with adenocarcinoma. The rectal growth was irradiated at a later date. This patient died from

Fig. 5. Epithelioma of the anus before irradiation with needles.

Fig. 6. S. S., aged 52 years. Result of irradiation of epithelioma of the anus. Note loss of sphincteric pucker and smooth scar on left side of anus. Two years and 6 months after treatment.

intestinal obstruction one month later. Careful histological examination was carried out of the rectal growth and perirectal tissues. The growth had been destroyed, but the rectal tissues still showed evidence of carcinoma. Examination of the glandular area failed to reveal any evidence of metastasis.

It often happens when carrying out an excision on a borderline case that the growth turns out to be more fixed than anticipated and the surgeon is faced with the fact that, although he has excised the rectum, malignant infiltration of the perirectal tissues may have occurred beyond the limits of excision. Then radium should be used to supplement surgery.

EPITHELIOMA OF THE ANUS

Squamous cell carcinoma of the anus has proved to be very responsive to interstitial radiation, and results are far better than for adenocarcinoma of the rectum. Surgery, at its best, involves a permanent colostomy. Radium can and does leave an anus which functions normally. It is often necessary to dissect out glands in the groin. Anal growths are not always squamous celled.

I have treated an adenocarcinoma occurring in the anus in the scar of an old fistula with radium and secured a perfect result with a soft pliable cicatrix and normal function. After 6 months, recurrence occurred with enlarged glands in one groin. Excision was then carried out with removal of glands.

This case illustrates the difference in response of the two types of growth. It is possible that with improved technique we may be able to prevent these recurrences. So far the cases of squamous carcinoma have not shown much tendency to recur.

I have endeavored to show what radium can do and how it fails. I recognize that there is much more to be done before we can attempt to dogmatize. In the present state of our knowledge I regard radium as a useful adjunct to surgery in skilled hands, and as a dangerous weapon in unskilled hands. It cannot replace surgery in rectal cancer, though it bids fair to do so in epithelioma of anus.

The rectal surgeon should regard radium as a spare horse to his team. He must recognize that this spare horse is not fully broken and is capable of dangerous antics. When harnessed to the team, a careful and experienced driver is required, if disaster is to be avoided.

CURABILITY OF CANCER OF THE STOMACH[1]

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THE fact that cancer of the stomach is curable is often obscured by the prevailing attitude of physicians and of laymen toward the disease. Although cures are rare, they are, to the surgeon, a constant reminder of his responsibility and of the fact that only he can offer the patient a possibility of cure. I am convinced that a more widespread understanding of the reasons why the patient with cancer of the stomach is usually denied any chance of cure will greatly increase the proportion of cases in which resection is possible, and will at least extend to such patients the benefits, temporary or permanent, which may accrue from thorough removal of a localized lesion. In the hope that study of a group of cases of cancer of the stomach in which cure has been obtained, may reveal information of value in treatment of this disease, I am presenting an analysis of the histories of 128 patients for whom partial gastrectomy for cancer of the stomach was done in the clinic between 1910 and 1920, and who lived 10 years or more following operation. Approximately 50 per cent of patients with cancer seen in the clinic during 1910 to 1920 were operated on, and in 39.3 per cent of these cases the cancer could be removed; these represent 19 per cent of the patients with gastric cancer who were seen.

In the last decade, 1920 to 1930, resection was possible in 43.16 per cent of the cases in which exploration was carried out, and this represents 22.62 per cent of the patients with gastric cancer who were seen. The present situation, therefore, is that in about half of the cases of cancer of the stomach exploration is warranted and in about half of these, the growth can be removed. These figures mean that at present an attempt at cure can be made in less than 25 per cent of cases of cancer of the stomach.

Careful study of the histories of these 128 patients, who lived ten years or more following resection for cancer, emphasizes the great variability in the disease. There is no characteristic syndrome of cancer of the stomach. Although there is a more or less constant syndrome in the average case, there are so many exceptions to the rule that the astute clinician will, by keen recognition of this fact, establish a diagnosis of the disease at a time when the symptoms are bizarre, and when surgery can offer some prospect of cure.

The average age in this group of patients was 52 years, but there were two patients aged between 20 and 30 years, respectively, and the ratio of males to females was 3 to 1. In 16 per cent of cases the family history was positive for cancer. The most striking fact in the history was that in 109 of the 128 cases dyspepsia had existed for a year or more. In 16 per cent there had been gross bleeding, and in 114 of the 128 there had been some loss of weight. Anæmia was seldom marked; the average concentration of hæmoglobin was 60 per cent, and in 75 per cent of the cases it was more than 50 per cent. Analysis of gastric content in these cases emphasized its unreliability as a diagnostic aid, for in 50 per cent of the cases the concentration of free hydrochloric acid was normal or above normal. In 30 per cent of the cases, some degree of retention was present.

The site of the growth was about equally divided between the antrum and body of the stomach; 51 per cent of the growths were classified as pyloric, and 49 per cent did not extend to the pylorus. In 33 per cent of the cases lymph nodes were shown to be involved by microscopic examination.

Grading, by Broders, of the tumors in the cases in which cure followed removal, showed that only 10 per cent could be graded 4, that is, as highly malignant; 55 per cent were graded 1 or 2, a relatively low degree of malignancy. These figures confirm the value of microscopic grading in these cases, as an aid to prognosis and as an indication for resection.

The types of operation employed in this group show the modifications in technique as developed during that period. In the earlier cases, the Billroth II operation was almost always used; then came the Pólya type, which shortened the time of operation and proved

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12-16, 1931.

equally satisfactory in other respects. It is of interest that in 6 cases in this group of 128 cured patients, local excision only was done, and that in only 4 cases was the Billroth I operation done.

This study has served to emphasize certain facts which are, in part at least, responsible for the present appalling situation; namely, that in a disease in which cure is possible, not even an attempt at cure can be made in 75 per cent of the cases when the patients are first seen. There are two major reasons for such a situation: the nature of the disease, and the delay in diagnosis and, consequently, of surgical treatment. It is these two factors which I wish first to consider.

THE NATURE OF THE DISEASE

It is unfortunately true that in a considerable number of cases of cancer of the stomach, the disease begins in a situation in which removal of the growth is prohibited even if diagnosis is early. A lesion in the fundus is the most unfavorable for many reasons, but chiefly because early symptoms are few and insignificant, and also because the lesion is relatively inaccessible. This is particularly true of lesions which involve the upper limits of the lesser curvature, for then the only procedure possible is total gastrectomy, and experience has shown that a lesion that is more or less confined to the lesser curvature is not the type of cancer for which total gastrectomy is indicated. When a high lying cancer is shown, roentgenologically, to involve chiefly the greater curvature and when the growth is palpable and movable, exploration should always be advised, since tumors which involve the posterior wall and greater curvature, even if they are high in the fundus, often can be mobilized and removed satisfactorily with prospect of cure. A most important fact in regard to any high, irremovable lesion is the possibility that it may be benign, and in prognosis this should always be taken into consideration if establishment of diagnosis by biopsy has not been feasible.

Lesions of the antrum, and those which extend to the pylorus, are commonly supposed to be the most favorable for both removal and cure, but this study has not confirmed such a view. The reason why the pyloric situation is not the most favorable is that the adjacent lymph nodes in this region are extensive, become involved early, and cannot be as thoroughly removed as the regional lymphatic structures of other segments of the stomach. Penetration posteriorly occurs earlier when growths are in this situation and this greatly decreases the possibility of cure. It is largely for these reasons that lesions at or near the outlet, from the standpoint of curability, take second place to lesions of the body of the stomach.

Cancer of the body of the stomach, if well demarcated, is most curable of any because of its accessibility, because of the completeness with which regional lymphatic structures can be removed, and because the mortality rate which accompanies resection of such growths is lower than that of resection of growths in any other situation in the stomach.

The size of a tumor of the stomach may give an erroneous impression as to operability. A large, freely movable cancer is more likely to lend itself to removal, as a rule, than is the cancer which cannot be palpated. Large tumors are usually of the colloid type, the lesion is sharply demarcated, and the walls of the uninvolved portion of the stomach are flexible, and, therefore, suitable for extensive resection and safe anastomosis. These facts are of practical importance, since it is a common impression that the large gastric tumor is irremovable, and that for this reason operation is not advised.

DELAY IN DIAGNOSIS

The chief reason for the fact that in only 25 per cent of the cases can the growth be removed, is failure to make an early diagnosis. So many factors contribute to this that I shall not attempt to consider them in detail. It cannot be too strongly emphasized that it is extremely difficult for even the most able clinician to make an early diagnosis of cancer of the stomach. The fault does not lie with the clinician but with the fact that symptoms and signs are either lacking or most insignificant in the early stages of the disease. The experienced clinician, recognizing this, will not delay until definite symptoms and signs ap-

pear, but will, on suspicion, demand not one but repeated fluoroscopic examinations by a competent roentgenologist. Such a clinician will not be deluded into believing that a patient who is in apparent good health, with normal values for gastric acids, with no loss of weight, with no palpable tumor, but with unexplained dyspepsia, cannot have cancer of the stomach. The first step, therefore, in successful treatment of cancer of the stomach depends on the wise clinician and a competent roentgenologist. It is, of course, most unfortunate that since the early symptoms of cancer of the stomach are so slight, patients do not seek advice early, a situation to be met only by public health education and periodic examination.

SURGICAL TREATMENT

Following recognition of a lesion of the stomach, the responsibility must be assumed by the surgeon. It is good practice to follow a rule that in all cases of cancer of the stomach exploration should be carried out unless recognizable irremovable metastatic growths can be demonstrated. Exceptions include cases of elderly patients in which roentgenologic examination results in the lesion being pronounced inoperable, and those in which there is clinical evidence of the cardia being involved. For young patients whose condition is not too poor, a fluoroscopic report of inoperability should not necessarily contraindicate exploration, since occasionally removal is possible under such circumstances. When rectal, umbilical, or supraclavicular implants can be demonstrated, operation is inadvisable except for obstruction of high grade; then gastro-enterostomy under local anæsthesia may be worth while to the patient.

Surgical treatment has two purposes in view: cure and palliation. Since this paper is concerned with the question of cure I shall not consider palliation, except to say that intelligent efforts at palliation, especially by partial gastrectomy, offer much to these patients. I have been much impressed with the number of patients who have lived in comfort, 2, 3, or 5 years following palliative resection; that is, patients who have irremovable metastatic growths. Removal of a cancer of the stomach, with reconstruction by the Billroth II method, or one of its modifications, gives almost certain assurance that obstruction will not develop; if death occurs it is due usually to metastasis to the liver, which, so far as pain is concerned, is relatively symptomless. It should be mentioned that a most effective surgical method of palliation, when the growth cannot be removed, is exclusion of the growth by division of the stomach above it, closure of the end of the involved segment, and restoration of continuity by an end-to-side gastrojejunostomy. In carefully selected cases, gastro-enterostomy alone gives real protection against disagreeable symptoms, or it may give some prolongation of life.

Maximal prospects of cure are attained by wide removal of the growth and regional lymphatic structures. The limitations of removal rest, to a considerable extent, on the experience of the surgeon, and on his willingness to undertake extensive resections, with their increased mortality rate. At the operating table, the decision of whether resection of the stomach is warranted is sometimes difficult to make. A safe rule is that if the disease is confined to the stomach, removal, unless it requires total gastrectomy, should be indicated.

The operation of total gastrectomy for cancer is justified only in those cases in which the stomach is sufficiently mobile that reasonable access to the œsophagus can be secured, and safe anastomosis between jejunum and œsophagus accomplished. Resections of less extent usually can be carried out if the disease is well demarcated and if the uninvolved portion of the stomach lends itself to safe anastomosis with the jejunum. The usual types of cancer, that is, the ulcerative or the colloid type, are well demarcated, but in the linitis plastica type it is not only difficult definitely to decide on the line of demarcation between diseased and normal tissue, but permanent cure in such cases is extremely rare. A most important point is that in some of the larger tumors, the uninvolved portion of the stomach above the growth may appear to be malignant tissue, because of rigidity and thickening of the gastric walls, and may lead the surgeon to decide against resection when the prospect of cure

may really be good. A further important fact in determining operability is to withhold decision until the patient is completely relaxed under anæsthesia and until any adhesions which can be divided have been severed. It is not an uncommon experience that a growth, examined while the patient is straining under light anæsthesia, appears irremovable, but that it proves under deep anæsthesia to be readily removed.

The regional lymphatic structures are large factors in treatment of cancer of the stomach. The four main groups: the suprapyloric, the subpyloric, and those of the greater and lesser curvatures, are sufficiently accessible that they can be removed with reasonable thoroughness. There are two facts of great importance regarding enlarged lymph nodes in cancer of the stomach: (1) enlargement does not necessarily mean involvement by cancer and (2) a patient may be cured even if all involved lymph nodes are not removed. The first fact is well known and undisputed and its practical importance is that it impels the surgeon to avoid the mistake of assuming incurability because of marked and extensive enlargement of regional nodes, a fact to which W. J. Mayo early drew attention. The second point is less easily substantiated, but sufficient examples are found in this series of cases of cured patients, in which the surgeon considered the resection only palliative because of incomplete removal of an involved chain of lymph nodes. I believe it to be a possibility that in cancer in any situation, removal of the primary growth and of the immediately adjacent lymphatic structures may bring about permanent cure even if involved lymph nodes are left; the remaining nodes in such cases act as a sufficient barrier to further dissemination of the disease. It is, therefore, occasionally good practice to disregard involvement of lymph nodes if the primary growth can be removed, and to remove the adjacent lymphatic structures as completely as possible.

The methods by which resection of the growth is accomplished are numerous. The surgeon acquires a preference for those methods which have served well. For this reason I believe that in all resections for cancer, the duodenal stump should be closed and gastrointestinal continuity restored by union between the remaining portion of the stomach and the jejunum. This principle has the advantage that, should recurrence take place, it is not associated with obstruction such as occurs if the resection has been of the Billroth I type. The methods of uniting stomach and jejunum will vary with the extent of the disease, condition of the patient, technical difficulties, and so forth. In a general way the more extensive the resection the more likely is an end- (stomach) to-side (jejunum) anastomosis with enteroanastomosis to be a safer procedure than others. In those cases in which the resected portion includes the greater part of the lesser curvature, or when the lesser curvature is friable or particularly difficult of access, a Billroth II, either posterior or anterior, is an excellent procedure. This method has the advantage of permitting safe and aseptic closure of the end of the stomach, and a small, secure anastomosis between stomach and jejunum.

The safety with which such procedures can be carried out is determined chiefly by the following: (1) pre-operative preparation, (2) anæsthesia, (3) selection of the operative procedure, (4) duration of operation and its technical perfection, and (5) after-care.

The preparation for operation of the patient with cancer of the stomach has two purposes: (1) cleansing of the stomach, and (2) correction of dehydration. These usually can be accomplished in 2 or 3 days, by performing gastric lavage as frequently as conditions dictate, and by intensive administration of fluids, solution of glucose and of physiologic solution of sodium chloride as indicated. Anæmia associated with cancer of the stomach, unless it is directly due to gross hæmorrhage, is not combated by transfusions. In addition, due regard should be given to the danger of the toxæmia of obstruction.

Anæsthesia, since pulmonary complications are the chief menace in such operations, is of great importance. Anæsthesia by inhalation should be as innocuous and as brief as possible. Ethylene has, therefore, definite advantages. My preference in the cases of more serious risks is for preliminary medication with barbiturates, abdominal wall block, and as much

ethylene as necessary. Spinal anæsthesia for extensive resections is, in my experience, not as safe a method of anæsthesia as the combination mentioned. I have been much impressed with the advantages of intratracheal anæsthesia for the obese, anæmic patient.

Selection of the type of operation is a large factor in the safety of resection. The procedure which is associated with the least technical difficulties commensurate with thorough removal of the growth, is the best. As I have stated, an anastomosis in front of the colon has distinct advantages in extensive resections, and is unquestionably safer than other procedures.

The details of technique are not within the scope of this paper, but it is pertinent to emphasize scrupulous cleanliness, absolute hæmostasis, carefully approximated suture lines sufficiently reinforced, and satisfactory mechanics. In extensive resections, and particularly in total gastrectomy, a catheter inserted directly into the jejunum, and left in place for introduction of fluids and nourishment, is unquestionably a factor of safety.

The after-care in cases of partial gastrectomy for cancer should be as simple as possible. Adequate intake of fluid by proctoclysis should be maintained, or, if proctoclysis is not tolerated, by intravenous administration. The stomach should be kept clean by aspiration when necessary, and taking of fluids by mouth should be forbidden for 48 hours or more. Transfusion in cases of bad risk is more useful when it is done immediately after operation than it is when done previous to operation or late after operation.

The mortality rate of partial gastrectomy for cancer of the stomach, under the foregoing regimen should be less than 10 per cent. In the last 200 cases in which I have done partial or total gastrectomy for cancer of the stomach there have been 10 deaths in hospital, a mortality rate of 5 per cent. Such a death rate in a disease in which an early and distressing death is inevitable, is not high, and emphasizes the indication for surgical exploration in all cases in which irremovable distant metastatic growths cannot be demonstrated. When it is also considered that resection of the growth offers the only prospect of cure, and that the 128 patients who lived 10 years or more following operation for cancer represents about 20 per cent of the patients for whom resection could be carried out, the curability of the disease is established.

IMPORTANCE OF NOMENCLATURE IN CANCER CLINICS[1]

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ALTHOUGH the main functions of the art of medicine are cure, palliation, and prevention of disease one of the first material necessities is a specific universal language for observational record, correlation, and communication of ideas.

Since our particular interest in this conference is cancer and related conditions, among the first things we should consider is the existing nomenclature as found in medical literature, teaching, and practice. I have collected from the literature of the last thirty years more than 950 terms applied to neoplastic conditions. It is sufficient to state that no textbook or medical dictionary contains all of these terms. This is very fortunate because many of them are meaningless and neither denote nor connote anything of cytological, histological, biological, or clinical value. Although still in general use, no pathologist or group of pathologists or clinicians would use all of these terms. No two authoritative textbooks have even the same small part of the whole group. They must be recognized temporarily, however, because they stand in the literature and will remain there with authority until some one presents a simpler conception of neoplastic conditions and coincidentally simplifies the terminology.

The following is a list of the collected terms now being used indiscriminately in medical literature. The terms are arranged under the letters of the alphabet, in the order of their frequency. One glance should be sufficient to reveal the chaotic and unscientific state of pathologic nomenclature applied to neoplastic conditions.

Adenoma
cysticum
sebaceum
sudorifarum
papillium
alveolare
destruens
papillare
tubulare
umbilicale
chorio- destruens
cyst- mucosum

Adenoma
cyst- atheromatosum
cyst- papilliferum
cyst- glandulare
cyst- phyllodes
cyst- pseudomucinosum
cyst- serosum
fibrosis
fibro- papillare
fibro- pericanaliculare
fibro- plexiform
fibro- acinosum

Adenoma
fibro- tubulare
fibro- papilliferum
intra- canaliculare
malignum
carcinomatosum
endotheliale
adamantinum
(simple)
(cystic)
(papillary)
(papillary cystic)
(pseudomucinous)
(cystic pseudomucinous)
(cystic fibro-)
(fibro-)
(fibro- cyst-)
(fibro- pericanalicular)
(polypoid)
(diffuse)
(tubular)
(benign)
(follicular)
(multiple)
(alveolar)
(malignant)
(malignant aleucæmic lymph-)
(cyst-)
(papillary cyst-)
(pseudomucinous cyst-)
(psammo- cyst-)
(serous cyst-)
(saccular)
(chondro-)
(myxo-)
(carcino-)
(lymph-)
(papillary epidermal)

Angioma
simplex
simplex hypertrophicans
simplex hypertrophicans lipomatosis renis
simplex hyperplasticum
lymph- cavernosum
lymph- hypertrophicum
lymph- tuberosum multiplex
lymph- cysticum
lymph- cystoides
lymph- simplex
lymph- fissurale
lymph- cutis circumscripta
hæm- plexiformis
hæm- cavernosum
hæm- hypertrophicum
hæm- sarcomatodes
arteriole racemosum
arteriale racemosum
arteriale serpentinium
cavernosum
hypertrophicum

Angioma
capillare
cirsoides
racemosum
telangiectaticum
telangiectodes
phlebogene
vinosum
varicosum
fissurale
sarcomatodes
(fibro-)
(lympho-)
(lymph-)
(lymph- (cystic)
(lymph- (simple)
(cystic lymph-)
(lipo- lymph-)
(hem- lymph-)
(hemato- lymph-)
(erectile lymph-)
(hæm-)
(hæm- telangiectatic)
(hæm- cavernous)
(hæmo-)
(chyle)
(plexiform)
(pedunculated)
(telangiectatic)
(cavernous)
(senile)
(Ranken)
(chol-)
(neuropathic)
(sarcomatous)
(capillary)
(capillary hæm-)
(hyperplastic capillary)

Adamantinoma
(solid)
(cystic)
(alveolar)
(tubular)
(dentigerous)
(odontoma)
(malignant)
(corono- dental)

Adenia
(aleucæmic)

Acanthoma
(adeno-)

Acrochordoma

Acervuloma

Blastoma
(tetralogenic)
(heterochthonous)
(fibro-)
(lipo-)
(epithelio-)
(erythro-)
(endothelio-)
(melano-)
(neuro-)
(myxo-)

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Blastoma—Continued
(glio-)
(myelo-)
(lympho-)
(osteo-)
(hemangio-)
(angio-)
(chordo-)
(choristo-)
(sympatho-)
(terato-)
(hemangio- endothelio-)
(leio- myo-) (leiomyoma)
(erythro- myelo-)
(disphyllic terato-)
(monophyllic terato-)
(hamarto-)

Carcinoma
sarcomatodes
durum
adenomatosum
mucosum
scirrhosum
medullare
fibrosum
colloides
gelatinosum
solidum
cysticum
cylindromatosum
simplex
acinosum
evertens
invertens
granulosum
tubulare
varia
myxomatodes
physaliferum
chondrosarcomatosum
villosum
papillosum
endotheliale
telangiectodes
adeno- cylindromatosum
cysto- simplex
cysto- papilliferum
cysto- papillare
cylindro- cellular solidum
medullare solidum
solidum scirrhosum
solidum medullare
solidum globocellulare
gigantocellulare
cylindrocellulare micro-cysticum
cylindrocellulare solidum
(alveolar)
(adenoid)
(adult)
(acinar)
(encephaloid)
(embryonal)
(soft)
(hard)
(simple)
(scirrhous)
(medullary)
(colloid)
(desmoplastic)

Carcinoma
(cystic)
(carium)
(diffuse)
(duct)
(fibrous)
(gelatinous)
(gallert)
(glandular)
(dermoid)
(polypoid)
(solid)
(tubular)
(tuberculous)
(thymic)
(medullary)
(papillary)
(epidermoid)
(osteoplastic)
(Abklatsch)
(cylinder cell)
(cystic papillary)
(Stachel cell)
(flat cell)
(squamous cell)
(polymorphic cell)
(small alveolar round cell)
(large alveolar round cell)
(papillary cylinder cell)
(large alveolar)
(small alveolar)
(hornifying epidermoid)
(adeno-)
(sarco-)
(chorio-)
(cysto-)
(fibro-)
(chondro-)
(melano-)
(psammo-)
(alveolar adeno-)
(cyst- adeno-)
(embryonal adeno-)
(papillary adeno-)
(pseudomucinous adeno-)
(tubular adeno-)
(papillary serous adeno-)
(cysto- cylindrocellulare)
(papillary cystic)

Cancer
atrophicans
nodulare
en cuirasse
(acinar)
(cauliflower)
(colloid)
(massif)
(nodular)
(scirrhous)
(villous)
(Zotten)
(papillary)
(endothelial)
(tubular scirrhous)
(villous duct)
(chimneysweep's)
(squamous cell)

Carcinosis
(miliary)

Cyst
(adenomatous)
(multilocular)
(dermoid)
(epidermoid)
(pseudo- papillary)

Cystoma
simplex
glandulare
papilliferum
papillares
pseudo- papillare
uniloculare
multiloculare
multiloculare pseudo-mucinosum
multiloculare serosum
(adeno-)
(multilocular adeno-)
(poly-)
(papillary)
(papillary adeno-)

Cytoma
adeno- papilliferum
adeno- papilliferum polyposum
(neuro-)
(adeno-)
(astro-)
(leuco-)
(malignant lymph-)
(malignant lympho-)
(myelo-) (myelo-blastoma)

Chondroma
cysticum
ossificans
myxomatodes
malignum
sarcomatodes
(adeno-)
(fibro-)
(osteo-)
(angio-)
(myxo-)
(fibro- myxo-)
(osteoid)

Chloroma
(lymphoid)
(lymphatic)
(lymphatic type)

Collonema
(lipoma myxomatodes)

Cornu cutaneum

Cirrhosis carcinomatosa

Choroida oculi

Cavernoma

Cylindroma

Chordoma

Clavus

Cholesteatoma

Chromatophoroma

Choristoma

Deciduoma malignum

Dermatocele lipomatosa

Desmoid

Desmoid
(myko-)

Dentinoid

Dermoid

Endothelioma
tubulare
alveolare
diffusum
psammosum
vasculare
hyalinum
fibrosum
fasciculare
fibroid
fibrosum interfasciculares
interfasciculare
intervasculare
perivasculare
hemangiomatosum
lymphangiomatosum
cylindromatodes
cylindromatosum
(capillary)
(circumscribed)
(cœlom)
(diffuse)
("derb")
(proliferous)
(fungoid)
(lymphangic)
(nodular)
(periosteal)
(plexiform)
(tuberous)
(alveolar)
(cystic)
(hyalogene)
(peri)
(perivascular)
(Gallert)
(lymph vessel)
(cystic papillary)
lipomatodes (xanthoma)
(angio-)
(hemangio-)
(lympho-)
(lymphangio-)
(fibro-)
(hemangio- tumerosum multiplex)
(perivascular hemangio-)
(sarcomatous hemangio-)
(malignant angio-)

Epithelioma
molluscum
canaliculare
intracanaliculare
basocellulare
folliculare
papillare
adamantinum cysticum
(adamantine)
(chorion)
(colloid)
(endocystic)
(placenta)
(papillary)
(simple adenoid)
(squamous cell)
(basal cell)
(giant cell)
(cystic papillary)
(cylinder cell papillary)
(fibro-)

Epithelioma—Continued
(chorio-)
(melano-)
(neuro-)
(fibro- papillare)
(papillary fibro-)
Elephantiasis
cavernosum
neuromatosa
mollis
neurofibromatosa
lymphangiectatica
(fibrous)
Epulis
myxomatosa
fibrosa
sarcomatosa
sarcomatosa gigantocellulare
carcinomatosa
carcinomatosum
Exostosis
eburnea
medullaris
fibrosis
cartilaginea multiplex
(cartilaginous)
Exostoses
(periosteal)
Enchondrosis
(ossifying)
Ekchondrosis physalifera
Ecchondrosis ossificans
Enchondroma
Ekchondrose
Entostosis
Exerzierknochen
Ekohymoma
Ephiledes
Epidermoids
Epulides
Embryoma
Fibroma
cavernosum
papillare
pendulum
molluscum
pericanaliculare
intracanaliculare
proliferum
arborescens
molle
durum
phyllodes
melanodes
sarcomatodes
malignum
petrificum
cysticum
lipomatodes
polyposum intracanaliculare
(cavernous)
(cystic)
(edematous)
(plexiform)
(papillary)
(cutaneous)
(nerve)
(Ranken)

Fibroma
(polypoid)
(placenta)
(pericanalicular)
(telangiectatic)
(edematous simplex)
(lymphangio-)
(neuro-)
(chondro-)
(cysto-)
(angio-)
(adeno-)
(myxo-)
(myo-)
(lipo-)
(neuro- plexiform)
(plexiform neuro-)
(adeno- edematodes cysticum)
(adeno- edematodes)
(adeno- myxo-)
(chondro- lipo-)
(lymphangio- lipo-)
(cystic calcareous)
(cystic adeno-)
(cystic intracanalicular papillary adeno-)
(calcareous intracanalicular adeno-)
Fibromatosis
(angio- genic)
(diffuse angio- genic)
Fibrosis
(adenoma)
Flimmerepithelzysten
Froschleingeschwulst
Folliculoma malignum ovarii
Glioma
ganglionaire
molle
durum
ependymare
sarcomatodes
malignum
neuro- ganglionaire
neuro- gangliocellulare
neuro- ependymale
neuro- gliomatosum microcysticum
ganglio- cellulare
telangiectaticum
(psammo-)
(myxo-)
(ependymal)
(solid)
(apoplectic)
(medullary)
(telangiectatic)
(retinal)
(malignant)
(teratomatous)
(paran)
(paran) (chromaffine tumor)
(giant cell)
Granuloma malignum
Hyperkeratosis
fungi formes
papillæ filliformes

Hyperkeratosis
lacunaris
Hodgkin's
disease
sarcoma
granulomatosis
lymphoma
Hypernephroma
(cortical)
(medullary)
(malignant)
Histiomata
(tissue tumors)
Hornkankroid
Hyperostosis
Hamartoma
Hauthorner
Hautkrebs
Hornifying cancroid
Keratoma
hereditarium
Keratosis
Keloid
(cicatrix)
Kavernoma
Lipoma
pendulum
telangiectodes
arborescens
telangiectaticum
cavernosum
myxomatodes
ossificans
sarcomatodes
sarcomatosum
lymphangiectaticum
molle
pendulans
fibrosum
durum
petrificum
intra nephritique
peri nephritique
annulare colli
(angio-)
(fibro-)
(chondro-)
(pedunculated)
Lipomatosis
regionaria
Lipomata
(symmetrical)
Lymphoma
sarcomatodes
(simple)
(lymphocytic)
(myelocytic)
(leucæmic)
(aleucæmic)
(malignant)
(symmetrical) (Mikulicz's disease)
(leucæmic) (lymphatic type)
(lymphatic leucæmic)
(leucæmic) (myeloid type)
(myeloid leucæmic)
(chloro-)
Lymphome
ganglionaire anemique

Leucæmia
(myeloid)
(myelogenous)
(lymphatic)
(pseudo-)
Leukoplacia
(linguæ) (psoriasis or ichthyosis)
Lympho-granuloma
(Hodgkin's disease)
Lymphosarcomatosis
Leucosarcomatosis
Linitis plastica
Myxoma
simplex
medullare
gelatinosum
molluscum
fibrosum
telangiectaticum
cavernosum
cysticum
pericanaliculare
intracanaliculare
lipomatodes
sarcomatodes
(congenital)
(nerve)
(polypoid)
(fibro-)
(lipo-)
(glio-)
(hemangio- blasto-)
(fibro- chondro-)
(pericanalicular fibro-)
Myoma
striocellulare
levocellulare
levicellulare
sarcomatodes
malignum
lymphangiectaticum
angio- cavernosum
rhabdo- malignum
leio- molle
leio- sarcomatodes
leio- malignum
leio- fibrosum
(lymphangiectatic)
(plexiform)
(telangiectatic)
(polypoid)
(cystic)
(fibrous)
(cavernous)
(leio-)
(rhabdo-)
(angio-)
(adeno-)
(fibro-)
(lipo-)
(cystic rhabdo-)
(adeno- rhabdo-)
(chondro- fibro-)
(fibro- lipo-)
(angio- lipo-)
(malignant leio-)
Macroglossia
(lymphangiectatic)
(lymphangiomatous)

Macroglossia—Continued
(hemangiomatous)
(hemo- lymphangiomatous)
Macrochielia
(lymphangiectatic)
(lymphangiomatous)
(hemangiomatous)
(hemo- lymphangiomatous)
Melanoma
sarcomatodes
Myeloma
sarcomatodes
Myelogenous
leucæmia
Mesothelioma
Neuroma
ganglionaire
ganglioniforme
myelinicum
amyelinicum
sarcomatodes
tubercula dolorosa
ganglionocellulare verum
gangliocellulare verum
gangliocellulare (neuroganglioma)
(amyelinic)
(central)
(cellular)
(false)
(fibrillar)
(ganglion)
(ganglionic)
(myelinic)
(traumatic)
(malignant)
(plexiform)
(true)
(Ranken)
(peripheral)
(cellular)
(fibro-)
(ganglio-)
(pseudo-)
Neurinoma
sarcomatodes
Nevus
vasculosis
pilosus
linearis
lipomatodes
vasculosi
flammeus
spilus
verruccus
nerven
vinosum
verrucosus durum
pigmentosus prominens
(cellular)
(cavernous)
(blue)
(lymph)
Nevi
plani
prominentes
lymphangiectatici
unis lateris
Nevi
vasculosi (angiomata)
ichthyosiformes
pilosi
pigmentosi (lymphangiomata, lymphangio-fibroma) (fibroma melanodes)
pigmentosi (related to lentigines and ephelides according to Ziegler)
Neurofibromatosis
(pigmented)
(visceral)
(von Recklinghausen's disease)
Osteoma
centrale
periphere
spongiose
medullare
durum
eburneum
sarcomatodes
sarcomatosum
malignum
(eburneous)
(dental)
(fibro-)
(chondro-)
(spongy) osteoma spongiosum or medullare
Odontoma
(dentinoid)
(hard)
(soft)
(adamantinoma)
(osteo-)
adamantinum
Osteophytes
Polyp
(cystic)
(choanal)
(chorion)
(glandular)
(Haar)
(simple)
(Rachen)
(placenta)
(telangiectatic)
(adenomatous)
(angiomatous)
(fibrous)
(carcinomatous)
(sarcomatous)
(epitheliomatous)
(myomatous)
(mucous)
(mixed tumor)
(papillary) (papilloma)
Polyposis
intestini
adenomatosa
ventriculi
Papilloma
myxomatodes
(vascular)
(mucous)
(squamous)
(neuropathic)
Papilloma
(endocystic)
(soft)
(cutaneous wart)
(aero- elevatum)
Perithelioma
melanoticum
(alveolar)
(telangiectatic)
(papillary)
(papillary) (of pia)
Pachydermia
neuromatosa
acquisita
Placentoma
Psammoma
Pentastomum
Perlgeschwulst
Pachydermatocele
Paget's disease
Phymoma or phyma
Polynuclear
giant cell neoplasm
Sarcoma
cylindromatosum
intracanaliculare
fusocellulare
phyllodes
carcinomatodes
myxomatodes
lymphomatodes
endotheliale
endotheloides
lymphadenoides
encephaloides
telangiectaticum
lymphaticum
tubulares
cylindroma
petrificans
cysto- phyllodes
deciduo- cellulare
angio-sarcoma
endotheloides
globo- cellulare
myo- striacellulare
globo- cellulare simplex
(scirrhous)
(colloid)
(alveolar)
(papillary)
(endothelial)
(telangiectatic)
(epitheloid)
(melanotic)
(perivascular)
(perithelial)
(petrifying)
(ossifying)
(periosteal)
(mixed)
(encephaloid)
(hemorrhagic)
(myeloid)
(ostecid)
(adeno-)
(carcino-)
(endothelio-)
(angio-)
(melano-)
Sarcoma
(chondro-)
(psammo-)
(fibro-)
(neuro-)
(myxo-)
(lipo-)
(glio-)
(lympho-)
(hemangio-)
(lymphangio-)
(cysto-)
(myo-)
(rhabdo-)
(osteo-)
(adeno- myo-)
(adeno- myxo-)
(adeno- cysto-)
(embryonal adeno-)
(angio- blastic)
(tubular angio-)
(telangiectatic angio-)
(Schlauch angio-) (angiosarcoma endotheloides)
(angio- myo-)
(perivascular angio-)
(plexiform angio-)
(papillary angio-)
(cysto- papilliferum)
(erythro- blastic)
(chondro- cysticum)
(chondro- blasto-)
(chondro- myxo-)
(chondro- osteoid)
(carcino- chondro-)
(osteo- chondro-)
(osteoid chondro-)
(myxo- blastic)
(myxo-, star cell and Netzzellen S. or myxoma sarcomatosum)
(myxo- lipo-)
(congenital myxo-)
(perivascular myxo-)
(plexiform myxo-)
(fibro- myxo-)
(lipo- myxo-)
(fibro- blastic)
(neuro- fibro-)
(fibro- osteo-)
(osteo- fibro-)
(periosteal fibro-)
(chloro- lympho-)
(melano- blastic)
(neuro- blastic)
(lipo- blastic)
(glio- blastic)
(osteo- blastic)
(myelo- blastic)
(myo- blastic)
(osteo- blastic)
(peripheral osteo-)
(myelogenous osteo-)
(central osteo-)
(osteo-) (myelogenous) (central)
(myelogenous) (central) (osteo-)
(osteo- genic)
(periosteal osteo-)

Sarcoma—Continued
(telangiectatic osteo-)
(malignant lympho-)
(leio- myo-)
(rhabdo- myo-)
(telangiectatic hemorrhagic alveolar)
(lymph gland)
(cylinder cell)
(pigmented cell)
(squamous cell)
(giant cell)
(reticulo- cellulare)
(reticulum cell)
(spindle cell)
(mixed cell)
(polymorphic cell)
(oat cell)
(round cell)
(warty spindle cell)
(giant cell angio-)
(giant cell myelogenous)
(perivascular spindle cell)
(small spindle cell)
(small oval cell)

Sarcoma
(myelogenous giant cell)
(large spindle cell)
(large cell lympho-)
(round cell osteo-)
(medullary round cell)
(spindle cell) (malignant leiomyoma)
(hemorrhagic round cell)
(large round cell)
(small round cell)
(large oval cell)

Sarcome
angiolithic

Sarcomatosis
(lympho-)

Struma
lipomatodes
lipomatodes aberrata
rens (heterotopes hypernephroma)
ovarii

Strumæ
suprarenalis
lipomatose suprarenali

Schlauchsarcoma
(Friedrich)

Syncytioma

Schleimkrebs

Teratoma
embryoma
autochthones
bigerminales
monogerminales
(adenomatous)
(cystic)
(filial)
(sporadic) (Adami)

Tumor
cavernosis
(amyloid)
(epithelial)
(Kruckenburg)
(mixed)
(nerve)
(histioid)
(organoid)
(cavernous)
(nerve fiber)
(plasma cell)
(chromaffine cell)
(extramedullary plasma cell)
(fibro- plastic)

Telangiectasis
(plexiform angioma)

Tyloma

Tridermoma

Warze
ichthyotische
(senile)

Wart
(cutaneous)
(pigment)
(fleshy)

Wasserkrebs

Xanthoma
palpibrarum
diabeticorum
multiplex
multiforme
universale
tuberosum
tuberculosum
planum
endothelioma
lipomatodes
fibroma
fibroma lipomatodes
(xanthelasma)

Xeroderma

In the inconvenient and impractical presence of this chaos I wish to present a simplification of nomenclature based upon a knowledge of the history of our subject, its literature, and a personal first hand experience in the study of cytology, histogenesis, and clinical behavior, of more than 50,000 human neoplastic conditions which were removed surgically.

There are three great groups of neoplasms:

I. Those composed of adult cells with normal tissue arrangement.

II. Those composed of cells normally or nearly normally arranged but having a morphology of malignant regenerative cells.

III. Those composed of cells of the malignant regenerative type not arranged in any fashion approaching that of any normal tissue.

Clinical surgical experience has taught us that neoplasms of the first group are not invasive and do not metastasize. They may interfere with the function of the organ or tissue containing them and sometimes, by their expansive growth, interfere with neighboring structures. They are spoken of as being clinically benign although they not infrequently kill their host and in this sense are sometimes just as malignant as groups II and III. In the literature, such terms as adenoma, osteoma, neuroma, myoma, and chondroma have been applied to tumors in this first group.

The second and third groups embrace the so called clinically malignant tumors, the adjective "malignant" usually connoting invasion of normal tissues by the new cells and their migration to other parts of the body, thus forming metastases. From a practical standpoint there is no great clinical difference between group II and group III. Both are malignant and both kill the host. The only differences are the histological pictures and the usual greater malignancy of group III. The therapy for the two groups is the same with our present knowledge.

Identification, recognition, and consideration of these three great groups are alone sufficient for all practical clinical purposes but since there are many types of tissues in the body, each group, especially the first two, embrace tumors composed of cells which belong to and simulate histologically one or more of the different tissues. For each normal tissue type of cell there are three forms: the adult or highly differentiated cells, the reparative regenerative forms, and the true neoplastic or malignant regenerative form.

Thus the first group of tumors is composed of textocytes or adult cells or their reparative regenerative forms. There are tumors of this group composed of:

adeno-
chondro-
endothelio-
epithelio-
fibro-
glio-
lipo-
lympho-
melano-
myo-
myxo-
neuro-
odonto-
osteo-
} cytes

Such tumors are the textocytomas. The individual tumors may be called:

GROUP I

adeno-
chondro-
endothelio-
epithelio-
fibro-
glio-
lipo-
lympho-
melano-
myo-
myxo-
neuro-
odonto-
osteo-
} cytomas (benign)

SYNONYMS[1] FOR GROUP I (CYTOMAS)

ADENOCYTIC SUBGROUP

Adenoma
- cysticum
- sebaceum
- sudorifarum
- papillium
- alveolare
- destruens
- papillare
- tubulare
- umbilicale
- fibrosis
- cyst- mucosum
- cyst- atheromatosum
- cyst- papilliferum
- cyst- glandulare
- cyst- phyllodes

Adenoma
- cyst- pseudomucinosum
- cyst- serosum
- chorio- destruens
- fibro- papillare
- fibro- pericanaliculare
- fibro- plexiform
- fibro- acinosum
- fibro- tubulare
- fibro-papilliferum
- intra- canaliculare
- (simple)
- (cystic)
- (papillary)
- (polypoid)
- (diffuse)

[1] Since it is impossible to find the original description for each term in the complete list it is possible that an occasional term in the subgroups might belong in some other group but in general the grouping is correct according to the experience of most pathologists and clinicians.

ADENOCYTIC SUBGROUP—Continued

Adenoma—Continued
- (tubular)
- (benign)
- (follicular)
- (multiple)
- (saccular)
- (alveolar)
- (cyst)
- (pseudomucinous)
- (cystic pseudomucinous)
- (papillary cyst)
- (papillary cystic)
- (serous cyst)
- (pseudomucinous cyst)
- (fibro-)
- (chondro-)
- (myxo-)
- (cystic fibro-)
- (fibro- cyst)
- (fibro- pericanalicular)

Cystoma
- simplex
- glandulare
- multiloculare
- uniloculare
- multiloculare pseudomucinosum
- multiloculare serosum
- (adeno-)

Polyp
- (cystic)
- (chorion)
- (glandular)
- (mucous)
- (simple)
- (placenta)
- (adenomatous)
- (papillary) (papilloma)

Polyposis
- adenomatosa ventriculi intestine

Papilloma
- (mucous)
- (endocystic)

Cytoma
- (poly)
- (multilocular adeno-)

Mole
- hydatidosa (Trauben)
- (Blasen)

Cyst
- (adenomatous)
- (multilocular)

Flimmerepithelzysten

Placentoma

CHONDROCYTIC SUBGROUP

Chondroma
- ossificans
- myxomatodes
- cysticum
- (adeno-)
- (fibro-)
- (osteo-)
- (myxo-)
- (angio-)

Chondroma
- (osteoid)
- (fibro- myxo-)

Enchondrosis
- (ossifying)

Enchondroma

Ekchondrose

Ekchondrosis physalifera

ENDOTHELIOCYTIC SUBGROUP

Endothelioma
- tubulare
- alveolare
- diffusum
- psammosum
- vasculare
- hyalinum
- fibrosum
- fasciculare
- interfasciculare
- intervasculare
- perivasculare
- cylindromatosum
- hemangiomatosum
- fibroid
- lipomatodes (xanthoma)
- fibrosum interfasciculares
- lymphomatosum cylindromatodes
- (capillary)
- (circumscribed)

Endothelioma
- (celom)
- (diffuse)
- ("derb")
- (proliferous)
- (fungoid)
- (lymphangic)
- (nodular)
- (periosteal)
- (plexiform)
- (tuberous)
- (alveolar)
- (cystic)
- (hyalogene)
- (perivascular)
- (peri)
- (cystic papillary)
- (lymph vessel)
- (angio-)
- (hemangio-)
- (lympho-)
- (lymphangio-)

ENDOTHELIOCYTIC SUBGROUP—Continued

Endothelioma—Continued
(fibro-)
(perivascular hemangio-)
Endothelioma
(hemangio- tumerosum multiplex)
Psammoma

EPITHELIOCYTIC SUBGROUP

Epithelioma
(fibro-)
(papillary fibro-)
Nevus
pigmentosus prominens
Nevi
prominentes
ichthyosiformes
pigmentosi (lymphangiomata, lymphangio- fibroma) (fibroma melanodes)
pigmentosi (related to lentigines and ephiledes according to Ziegler)
Wart
(cutaneous)
(fleshy)
(pigment)
Warze
ichthyotische
Warze
(senile)
Hyperkeratosis
lacunaris
fungi formes
papillæ filliformes
Papilloma
(squamous)
(cutaneous wart)
Leucoplacia
(linguæ) (psoriasis or ichthyosis)
Cornu cutaneum
Keratoma hereditarium
Hornifying cancroid
Hornkankroid
Cyst
(epidermoid)
Keratoma
Keratosis

FIBROCYTIC SUBGROUP

Fibroma
cavernosum
pendulum
molluscum
proliferum
petrificum
cysticum
molle
durum
phyllodes
melanodes
lipomatodes
papillare
pericanaliculare
intracanaliculare
arborescens
polyposum intercanaliculare
(cavernous)
(cystic)
(edematous)
(plexiform)
(papillary)
(cutaneous)
(nerve)
(Ranken)
(polypoid)
(placenta)
(pericanalicular)
(telangiectatic)
(cystic calcareous)
(myo-)
(lipo-)
(chondro-)
(lymphangio-)
Fibroma
(neuro-)
(cysto-)
(angio-)
(adeno-)
(myxo-)
(adeno- myxo-)
(chondro- lipo-)
(lymphangio- lipo-)
(neuro- plexiform)
(plexiform neuro-)
(adeno- edematodes)
(adeno- edematodes cysticum)
(cystic adeno-)
(calcareous intracanalicular adeno-)
(cystic intracanalicular papillary adeno-)
(edematous simplex)
Myxoma
simplex
medullare
gelatinosum
molluscum
fibrosum
cavernosum
cysticum
telangiectaticum
pericanaliculare
intracanaliculare
lipomatodes
(congenital)
(nerve)
(polypoid)

FIBROCYTIC SUBGROUP—Continued

Myxoma
(fibro-)
(lipo-)
(fibro- chondro-)
(hemangio- blasto-)
(pericanalicular fibro-)
Perithelioma
melanoticum
(alveolar)
(telangiectatic)
(papillary)
(papillary) (of pia)
Papilloma
myxomatodes
(vascular)
(soft)
Nevus
verrucus
verrucosus durum
Epulis
fibrosa
Epulis
myxomatosa
Desmoid
(myko-)
Polyp
(fibrous)
Epithelioma
molluscum
Angioma
(fibro-)
Fibrosis
(adenoma)
Keloid
(cicatrix)
Neurinoma
Polynuclear
giant cell neoplasm
Fibromatosis
(angio-genic)
(diffuse angio-genic)
Blastoma
(fibro-)

GLIOCYTIC SUBGROUP

Glioma
ganglionaire
ganglio- cellulare
neuro- ganglionaire
neuro- gangliocellulare
(psammo-)
Glioma
(neuro- gliomatosum microcysticum)
Myxoma
(glio-)

LIPOCYTIC SUBGROUP

Lipoma
arborescens
cavernosum
molle
pendulans
fibrosum
durum
myxomatodes
ossificans
petrificum
telangiectodes
telangiectaticum
lymphangiectaticum
annulare colli
intranephritique
perinephritique
(pendulum)
(pedunculated)
Lipoma
(angio-)
(fibro-)
(chondro-)
Lipomata
(symmetrical)
Lipomatosis
regionaria
Nevus
lipomatodes
Angioma
simplex
hypertrophicans
lipomatosis renis
Blastoma
(lipo-)

LYMPHOCYTIC SUBGROUP

Lymphoma
(simple)
(lymphocytic)
Lymphoma
(symmetrical)
(Mikulicz's disease)

MYOCYTIC SUBGROUP

Myoma
striocellulare
levocellulare
Myoma
lymphangiectaticum
levicellulare (Virchow)

MYOCYTIC SUBGROUP—Continued

Myoma—Continued	Myoma
striocellulare (Virchow)	(adeno-)
leio- fibrosum	(fibro-)
(lymphangiectatic)	(lipo-)
(telangiectatic)	(angio-)
(polypoid)	(adeno- rhabdo-)
(plexiform)	(fibro- lipo-)
(cystic)	(angio- lipo-)
(fibrous)	(chondro- fibro-)
(cavernous)	(cystic rhabdo-)
angio- cavernosum	Polyp
leio- molle	(myomatous)
(leio-)	Blastoma
(rhabdo-)	(leio- myo-) (leiomyoma)

NEUROCYTIC SUBGROUP

Neuroma	Neuroma
ganglionaire	(ganglionic)
ganglioniforme	(myelinic)
myelinicum	(traumatic)
amyelinicum	(malignant)
ganglionocellulare verum	(plexiform)
tubercula dolorosa	(fibro-)
gangliocellulare (neuro-ganglioma)	(ganglio-)
(true)	(pseudo-)
(Ranken)	Neurofibromatosis
(peripheral)	(pigmented)
(amyelinic)	(visceral)
(central)	(von Recklinghausen's disease)
(cellular)	Nevus (nerven)
(false)	Papilloma (neuropathic)
(fibrillar)	Blastoma (neuro-)
(ganglion)	Cytoma (neuro-)

OSTEOCYTIC SUBGROUP

Osteoma	Exostosis
centrale	(cartilaginous)
periphere	eburnea
spongiose	medullaris
medullare	fibrosis
durum	cartilaginea multiplex
eburneum	Exostoses (periosteal)
eburneous	Ecchondrosis ossificans
(dental)	Entostosis
(spongy) (osteoma spongiosum or medullare)	Hyperostosis
(fibro-)	Osteophytes
(chondro-)	Exerzierknochen

ODONTOCYTIC SUBGROUP

Adamantinoma	Adamantinoma
polycysticum	(solid)

ODONTOCYTIC SUBGROUP—Continued

Adamantinoma	Odontoma
(cystic)	(dentinoid)
(alveolar)	(hard)
(tubular)	(soft)
(dentigerous)	(adamantinoma)
(odontoma)	(osteo-)
(corono- dental)	Dentinoid
Odontoma	Epithelioma (adamantine)
adamantinum	

ANGIOCYTIC SUBGROUP

Angioma	Angioma
cavernosum	(lymph- (cystic)
hypertrophicum	(lymph- (simple)
telangiectaticum	(hem- lymph)
vinosum	(hemato- lymph)
varicosum	(lipo- lymph)
racemosum	(lympho-)
capillare	(capillary hem-)
cirsoides	Nevus
phlebogene	vasculosis
fissurale	linearis
simplex	vasculosi
arteriole racemosum	flammeus
arteriale racemosum	vinosum
arteriale serpentinium	(cavernous)
simplex hyperplasticum	(blue)
hemo-	(lymph)
hem- plexiformis	Nevi
hem- cavernosum	lymphangiectatici
hem- hypertrophicum	vasculosi (angiomata)
hem– (telangiectatic)	Macroglossia
hem- (cavernous)	(lymphangiectatic)
lymph- cavernosum	(lymphangiomatous)
lymph- hypertrophicum	(hemangiomatous)
lymph- cysticum	(hemo- lymphangiomatous)
lymph- cystoides	Machrochielia
lymph- simplex	(lymphangiectatic)
lymph- fissurale	(lymphangiomatous)
lymph- cutis circumscripta	(hemangiomatous)
lymph- tuberosum multiplex	(hemo- lymphangiomatous)
(chyle)	Aneurysm racemosum
(lymph)	Telangiectasis
(plexiform)	(plexiform angioma)
(pedunculated)	Angio- textocytoma
(telangiectatic)	Kavernoma
(cavernous)	Cavernoma
(senile)	Lymphangiectasis
(capillary)	Blastoma
(hem)	(angio-)
(Ranken)	(hemangio-)
(chol)	Polyp
(erectile lymph)	(angiomatous)
(cystic lymph)	(telangiectatic)
(hyperplastic capillary)	

The second group of tumors (blastomas) is composed of undifferentiated or partially differentiated cells of a malignant regenerative type arranged in a fashion resembling somewhat the normal tissue arrangement. The cells themselves differ from adult and reparative regenerative cells in that they have larger nucleoli (one or more) in granular nuclei which occupy a large part of the cell. Reparative regenerative cells are more delicate in

appearance; the nucleoli are smaller in proportion to the nucleus and the cells themselves are apt to be arranged more regularly. The component cells of the second group of tumors are a younger type; they are more primitive textoblasts—the cells from which the adult cells are normally regenerated. The tumors of this group, being composed essentially of textoblastic cells, may be called textoblastomas. One finds in this group:

GROUP II

adeno-
chondro-
endothelio-
epithelio-
erythro- *
fibro-
glio-
leuco- †
lipo-
lympho- ‡
melano-
myo-
myxo-
neuro-
odonto-
osteo-
} blastomas (malignant)

*In pernicious anemia.
†In myelogenous leucemia.
‡In lymphatic leucemia, lympho-sarcoma, and Hodgkin's disease.

To this group belong the various adenocarcinomas, spindle cell sarcomas, myosarcomas, osteosarcomas and chondrosarcomas, some of the gliomas, and many others which space does not permit mentioning.

SYNONYMS FOR GROUP II (BLASTOMAS)

ADENOBLASTIC SUBGROUP

Adenoma
malignum
carcinomatosum
(malignant)
(carcino-)
Carcinoma
durum
adenomatosum
mucosum
scirrhosum
fibrosum
gelatinosum
solidum
cysticum
cylindromatosum
acinosum
granulosum
vilosum
Carcinoma
papillosum
physaliferum
medullare
colloides
simplex
evertens
invertens
tubulare
varia
gigantocellulare
myxomatodes
medullare solidum
cylindrocellulare solidum
solidum globocellulare
solidum scirrhosum
solidum medullare
adeno- cylindromatosum

ADENOBLASTIC SUBGROUP—Continued

Carcinoma
cysto- papillare
cysto- simplex
cysto- papilliferum
sarcomatodes
(very cellular)
cylindrocellulare microcysticum
cylindro-cellular solidum
cysto- cylindrocellulare
(alveolar)
(adenoid)
(adult)
(acinar)
(encephaloid)
(embryonal)
(Abklatsch)
(soft)
(hard)
(simple)
(scirrhous)
(medullary)
(colloid)
(desmoplastic)
(cystic)
(carium)
(diffuse)
(duct)
(fibrous)
(gelatinous)
(Gallert)
(glandular)
(polypoid)
(solid)
(tuberculous)
(tubular)
(thymic)
(medullary)
(papillary)
(cystic papillary)
(cylinder cell)
(polymorphic cell)
(papillary cystic)
(small alveolar)
(small alveolar round cell)
(large alveolar round cell)
(papillary cylinder cell)
(Stachel cell)
(large alveolar)
(sarco-)
(chorio-)
(cysto-)
(fibro-)
(adeno-)
(alveolar adeno-)
(cyst- adeno-)
(embryonal adeno-)
(papillary adeno-)
(pseudomucinous adeno-)
(tubular adeno-)
(papillary serous adeno-)
Cancer
nodulare
atrophicans
en cuirasse
(acinar)
(cauliflower)
Cancer
(colloid)
(massif)
(nodular)
(scirrhous)
(villous)
(Zotten)
(papillary)
(tubular scirrhous)
(villous duct)
Sarcoma
cylindromatosum
carcinomatodes
intracanaliculare
phyllodes
deciduo- cellulare
(colloid)
(alveolar)
(papillary)
(cylinder cell)
(adeno-)
(carcino-)
(adeno- myxo-)
(adeno- cysto-)
(embryonal adeno-)
(cysto- papilliferum)
cysto- phyllodes
Epithelioma
canaliculare
intracanaliculare
(chorion)
(colloid)
(endocystic)
(cylinder cell papillary)
(chorio-)
(placenta)
(simple adenoid)
Struma
lipomatodes
lipomatodes aberrata rens (heterotopes hypernephroma)
ovarii
Strumæ
suprarenalis
lipomatose suprarenali
Cystoma
papilliferum
papillares
pseudo papillare
(papillary)
(papillary adeno-)
Polyp
(carcinomatous)
(sarcomatous)
(epitheliomatous)
Hypernephroma
(cortical)
(medullary)
(malignant)
Cytoma
adeno- papilliferum
adeno- papilliferum polyposum
(adeno-)
Cyst
(pseudo- papillary)

ADENOBLASTIC SUBGROUP—Continued

Deciduoma malignum
Folliculoma malignum ovarii
Cirrhosis carcinomatosa
Linitis plastica
Endothelioma (Gallert)
Schlauchsarcoma
Cylindroma
Syncytioma
Schleimkrebs
Mesothelioma

CHONDROBLASTIC SUBGROUP

Sarcoma
chondro- cysticum
(chondro-)
(chondro- blastic)
(chondro- myxo-)
(carcino- chondro-)
Chondroma
malignum
sarcomatodes
Carcinoma
chondrosarcomatosum
(chondro-)

ENDOTHELIOBLASTIC SUBGROUP

Sarcoma
endotheliale
endothelioides
tubulares
cylindroma
telangiectaticum
angio- sarcoma endotheliolides
(endothelial)
(telangiectatic)
(telangiectatic hemorrhagic alveolar)
(endothelio-)
(angio-)
(psammo-)
(tubular angio-)
(telangiectatic angio-)
Sarcoma
(Schlauch angio-) (angiosarcoma endothelioides)
(angio- blastic)
(angio- myo-)
(telangiectatic myxo-)
Sarcome angiolithic
Endothelioma
(malignant angio-)
(sarcomatous hemangio-)
Carcinoma
endotheliale
(psammo-)
Blastoma
(endothelio-)
(hemangio- endothelio-)
Cancer (endothelial)
Endothelioma (myeloid)

EPITHELIOBLASTIC SUBGROUP

Epithelioma
basocellulare
folliculare
papillare
fibro- papillare
(papillary)
(cystic papillary)
(squamous cell)
(basal cell)
(giant cell)
(melano-)
(papillary fibro-)
Sarcoma
(epithelioid)
(melanotic)
(pigmented cell)
(squamous cell)
(warty spindle cell)
(melano-)
(melano- blastic)
Carcinoma
(dermoid)
(epidermoid)
(hornifying epidermoid)
(flat cell)
(squamous cell)
(melano-)
Cancer
(squamous cell)
(chimneysweep's)
Blastoma
(epithelio-)
(melano-)
Melanoma
sarcomatodes
Paget's disease
Perlgeschwulst
Rodent ulcer
Hautkrebs

ERYTHROBLASTIC SUBGROUP

Chloroma
(lymphatic)
Chloroma
(lymphatic type)

ERYTHROBLASTIC SUBGROUP—Continued

Chloroma
(lymphoid)
Blastoma
(erythro-)
Lymphoma
(chlorotic)
Sarcoma
(erythro-blastic)
(chloro- lympho-)
Pernicious anemia

FIBROBLASTIC SUBGROUP

Sarcoma
myxomatodes
(perivascular)
(petrifying)
(perithelial)
(scirrhous)
(giant cell)
(reticulum cell)
(spindle cell)
(small spindle cell)
(small oval cell)
(myelogenous giant cell)
(large spindle cell)
(giant cell myelogenous)
(perivascular spindle cell)
(fibro-)
(neuro-)
(myxo-)
(lipo-)
(fibro- blastic)
(giant cell angio-)
(perivascular angio-)
(myxo- lipo-)
(perivascular myxo-)
(neuro- fibro-)
Sarcoma
(neuro- blastic)
(congenital myxo-)
(fibro- myxo-)
(lipo- blastic)
(myxo- blastic)
(plexiform myxo-)
(myxo-, star cell and Netzzellen S. or myxoma sarcomatosum)
(lipo- myxo-)
reticulo- cellulare
Epulis
sarcomatosa
carcinomatosa
carcinomatosum
sarcomatosa gigantocellulare
Fibroma
sarcomatodes
malignum
Neuroma sarcomatodes
Neurinoma sarcomatodes
Myxoma sarcomatodes
Blastoma (myxo-)

GLIOBLASTIC SUBGROUP

Glioma
molle
durum
malignum
telangiectaticum
sarcomatodes
neuro- ependymale
(ependymal)
(ependymare)
(solid)
(apoplectic)
(medullary)
(telangiectatic)
(retinal)
(paran)
Glioma
(malignant)
(paran) (chromaffine tumor)
(giant cell)
(myxo-)
Sarcoma
(glio-)
(glio- blastic)
Blastoma
(glio-)
Cytoma
(astro-)
Blastoma
(spongio-)

LIPOBLASTIC SUBGROUP

Lipoma
sarcomatodes
Lipoma
sarcomatosum

LEUCOBLASTIC SUBGROUP

Lymphoma
(myelocytic)
(myeloid leucemic)
(leucemic) (myeloid type)
Sarcoma
(myelogenous)
(myeloid)
(myelo- blastic)

LEUCOBLASTIC SUBGROUP—Continued

Myelogenous leucemia
Cytoma (myelo-) (myeloblastoma)
Blastoma (myelo-) (erythro- myelo-)
Leucemia (myeloid) (myelogenous)
Myeloma
Myeloma sarcomatodes

LYMPHOBLASTIC SUBGROUP

Lymphoma
sarcomatodes (leucemic) (aleucemic) (malignant) (lymphatic leucemic) (leucemic) (lymphatic type)
Lymphome ganglionairie anemique
Sarcoma
lymphadenoides
lymphomatodes
lymphaticum (lympho-) (large cell lympho-) (malignant lympho-) (lympho- blastic)
Cytoma (malignant lymph)
Cytoma (malignant lympho-) (leuco-)
Blastoma (lympho-)
Leucemia (lymphatic) (pseudo-)
Hodgkin's disease
sarcoma granulomatosis lymphoma
Lymphosarcomatosis
Leucosarcomatosis
Lympho-granuloma (Hodgkin's disease)
Adenia (aleucemic)
Sarcomatosis (lympho-)
Adenoma (malignant aleucemic lymph)

MYOBLASTIC SUBGROUP

Myoma
sarcomatodes malignum
leio- sarcomatodes rhabdo- malignum
leio- malignum (malignant leio-)
Sarcoma
myo- striacellulare
fuso- cellulare
Sarcoma (oat cell) (spindle cell) (malignant leio- myoma) (myo-) (rhabdo-) (rhabdo- myo-) (leio- myo-) (myo- blastic) (adeno- myo-)

ODONTOBLASTIC SUBGROUP

Epithelioma adamantinum cysticum
Adamantinoma (malignant)

ANGIOBLASTIC SUBGROUP

Sarcoma (hemangio-) (lymphangio-) (plexiform angio-) (angio- blastic)
Angioma
sarcomatodes
hem- sarcomatodes
Angioma telangiectodes (probably angio II)
Carcinoma telangiectodes
Angioma (sarcomatous)
Angio-textoblastoma

There is the third group composed of the malignant type of regenerative cells which are even more primitive in so far as differentiation is concerned, than those of the second group; they grow throughout the tissues and have no arrangement characteristic or suggestive of that of any normal tissue. It is a group in which it is often impossible to say whether the cells are ectoblastic, mesoblastic, or endoblastic according to the older classifications. Many such tumors have been dumped in that nondescript classification of sarcomas. I have, for years, thought of these cells as protextoblasts and have described such tumors as protextoblastomas or problastomas. Since there is no resemblance to normal tissues there can be no prefix such as has been used for the first and second groups.

GROUP III (SYNONYMS) (PROBLASTOMAS)

Sarcoma
encephaloides
globocellulare simplex
globocellulare (mixed) (encephaloid)
Sarcoma (hemorrhagic) (lymph gland) (mixed cell) (polymorphic cell) (round cell)
Sarcoma (large round cell) (small round cell) (large oval cell)
Sarcoma (hemorrhagic round cell) (cysto-) (papillary angio-)

In the literature one finds many terms which are rather nondescript; some may not even be true neoplastic conditions. Just where they belong in any classification will probably always be open to contention and wasteful discussion.

MISCELLANEOUS TERMINOLOGY

Adenoma
adamantinum
endotheliale (lymph) (papillary epidermal) (psammo- cyst-) (sarco-) (adenosarcoma)
Adenia simplex
Acanthoma (adeno-)
Angioma (neuropathic)
Acervuloma
Acrochordoma
Blastoma (tetralogenic) (heterochthonous) (hamarto-) (chordo-) (choristo-)
Blastoma (sympatho-) (terato-) (disphyllic terato-) (monophyllic terato-) (Adami)
Bidermoma
Callositas (Tyeloma)
Collonema (lipoma myxomatodes)
Chordoma
Collonema
Clavus
Cholesteatoma
Chromatophoroma
Choroida oculi
Choristoma
Dermatocele lipomatosa

MISCELLANEOUS TERMINOLOGY—Continued

Elephantiasis
  cavernosum
  neuromatosa
  mollis
  neurofibromatosa
  lymphangiectatica
  (fibrous)
Epithelioma
  (neuro-)
  (neuro- gliomatosum)
  (neuro- gliomatosum ganglio- cellulare)
  (neuro- gliomatosum columno- cellulare)
Endothelioma
  cholesteatomatosum
  (carcino- sarco-)
Ekchymoma
Ephelides
Epidermoids
Epulides
Froschleingeschwulst
Granuloma malignum
Hamartoma
Hauthorner
Histiomata (tissue tumors)
Nevus
  pilosus
  spilus
  (cellular)
Nevi
  plani
  pilosi
  unis lateris
Polyp
  (choanal)
  (Haar)
  (Rachem)
Papilloma
  (aero- elevatum)
Pachydermatocele
Phymoma or phyma
Pentastomum
  (see Kaufmann)
Pachydermia
  neuromatosa
  acquisita
Tumor
  cavernosis
  (amyloid)
  (epithelial)
  (Kruckenburg)
  (mixed)
  (nerve)
  (histioid)
  (organoid)
  (cavernous)
  (chromaffine cell)
  (plasma cell)
  (extra medullary plasma cell)
  (fibro- plastic)
  (nerve fiber)
Tyloma (callositas)
Tridermoma
Wasserkrebs
Xanthoma
  palpebrarum
  diabeticorum
  multiplex
  multiforme
  universale
  tuberosum
  tuberculosum
  planum
  fibroma
  fibroma lipomatodes
  endothelioma lipomatodes
  (xanthelasma)
Xeroderma pigmentosum

It seems reasonable to consider all dermoids and teratomas as polycytomas or polyblastomas depending upon the morphological characteristics of the cells. At least these two terms would designate whether or not they were malignant or benign.

POLYCYTOMAS

Teratoma
  embryoma
  authchthones
  bigerminales
  monogerminales
  (adenomatous)
  (cystic)
  (filial)
Teratoma
  (sporadic) (Adami)
Dermoid
Cyst (dermoid)
Embryoma
Glioma (teratomatous)
Polyp (mixed tumor)

For practical diagnostic, prognostic, and therapeutic purposes only three words are essential: cytomas, blastomas, and pro-blastomas, provided we adhere to the definitions which have been stated. The first is benign—does not metastasize but grows expansively; the two last grow invasively and metastasize. The first group requires local removal and the second and third groups require radical removal.

Prognosis in all is dependent upon at least seventeen known factors: the type of neoplasm, the size of the growth, anatomical location, presence or absence of lymph-nodal involvement and metastasis, fixation of the growth, renal and cardiac efficiency, presence or absence of anemia, age of the host, duration of the disease, direction of growth, presence or absence of loss of weight, presence or absence of cellular differentiation, lymphocytic infiltration, fibrosis, and hyalinization, and, finally, upon the extent of the destruction produced by therapy.

NEWER DEVELOPMENTS IN X-RAY THERAPY OF CANCER[1]

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THE expression "deep roentgen therapy" means to most of us the treatment almost exclusively of neoplasms. Probably not more than 15 per cent of the so called deep roentgen-ray treatments are given for other diseases. To name the processes in which deep roentgen-ray therapy seems indicated, and has been or is being employed, would be to enumerate practically all of the benign or malignant neoplastic processes, and the allied diseases. This great group accounts for probably 80 to 90 per cent of all deep roentgen-ray treatments, the remaining 10 to 20 per cent consisting, of course, in the treatment of a variety of inflammatory processes and glandular diseases.

However, it is quite true, that the use of the roentgen-ray has been extended with notable advancement in this latter field, during the last few years, and it appears that a new chapter on the effect of various amounts of the roentgen-rays on deranged or altered gland function has been opened.

Roentgenologists and others who have had an opportunity of observing the effect of various doses of roentgen-rays on certain ductless glands are impressed with the definite and often quite startling changes produced, and without much play of the imagination, visualize a wider and more scientific application of roentgen-rays for the numerous conditions directly and indirectly resulting from derangements of the endocrine system.

The extent to which the abuses of roentgen-rays occur in this field, as also in the treatment of neoplasms, is difficult to estimate. The dangers of irreparable damage being done in its use for the stimulation or depression of ovarian, thyroid, and other gland function, and in its uncontrolled application to produce abortions, and in its use in goiters and uterine myofibromata in young adults, not to mention numerous other conditions, should be kept in mind constantly by those responsible for the exposures. The need for greater care in its use in this field than in that of cancer is obvious.

It is believed, however, that the surface has been barely scratched in the application of roentgen-rays in the treatment of acute and chronic inflammations and diseases associated with derangement of ductless glands.

To those roentgenologists who have had an opportunity of following and examining the same patients over a period of many years following roentgen-ray therapy, there comes an appreciation of the late or remote roentgen-ray effects, and the various manifestations of irradiation, some of which are confused with other disease processes, and a conservative rational attitude toward roentgen-rays and their usefulness in the treatment of disease, which is lacking in the surgeon or internist whose observations are more limited and casual.

It should not be concluded, however, that the views of roentgenologists regarding the value and limitations of roentgen-ray therapy have crystallized, or that they believe it has come to occupy a definite or limited position in physical therapy, or that standardized methods of administering doses except in a very few diseases have been adopted to date. It is obvious that as the nature and etiology of cancer remains obscure, many theories will be advanced in support of the different methods and dosages employed in the treatment of this great variety of diseases. Hardly a year passes without a new technique or method of administering a dose of roentgen-ray being advocated in the treatment of cancer.

We have the fractionated dose method, i.e., small doses of heavily filtered high voltage roentgen-rays given frequently over a long period of time. By this method three or four times as much radiation can be given to the tumor without immediate evidence of damage to the skin as may be administered at a single exposure. The critics of this method state that although it is true that the skin stands this treatment very well, so does the cancer. In France and elsewhere Regaud's theory of "mother and daughter cells" is used in support of

[1]Presented in the Cancer Symposium, Clinical Congress of the American College of Surgeons, New York, October 15, 1931.

this and similar methods of prolonged radiation. Advocates of such methods believe cancer cells are more susceptible during the stages of division, and that by irradiating the tumor over a prolonged period of time, "mother and daughter" cells are more apt to be exposed at the time of greatest susceptibility. The exponents of the massive dose methods state that although this may be true, they prefer to employ a dose heavy enough to knock out the mother cell so that it will not have any daughters. So there was the massive dose method employed largely in Germany by Seitz and Wintz and others. But a year or two after the publication of descriptions of the method and technique of administering what was termed the "carcinoma dose," which varied around 100 or 110 per cent of an erythema dose, reports appeared in the literature indicating that the results were not as desirable or favorable as the earlier articles indicated. In many patients, areas of destruction of normal tissue occurred, following slowly the development of obliterative endarteritis; in others the tumors recurred and grew into or through structures undergoing fibrotic changes induced by the X-ray.

Another interesting variation is the saturation technique, invented by Kingery, but enthusiastically developed by Pfahler and a large Philadelphia group. This is based on the theory of quantitative loss of biological effect of radiation with successive days. An exponential curve was built up, on the law of mass reactions, which is theoretical, but which this group claims "works." According to this theory, the total effect of a high voltage single dose is lost in 8 weeks. The curve would indicate:

75 per cent value persists at 4½ days.
50 per cent value persists at 12 days.
25 per cent value persists at 25 days.
15 per cent nearly a flat line from here on—at 40 days.

Following this reasoning, they add 50 per cent more of the original skin toleration dose at the end of 2 weeks, 75 per cent after 4 weeks (actually they add smaller percentages at closer intervals), maintaining a total of from 200 to 500 per cent over a period of, I believe, a month.

The opponents of this procedure, of whom there are many, say that (1) if the skin can tolerate all this radiation, doubtless the tumor can too, without ill effects; (2) the exponential curve is theoretical; (3) the skin may break down badly later, if the patient survives; and (4) it takes a great deal of time and trouble and tube energy, and if unsound is over-expensive.

For irradiation therapy to survive and progress, it is imperative that the pain and suffering incident to and resulting from the use of radium and roentgen-rays be minimized to a point consistent with the best result reasonably to be expected. For a patient to succumb to the effects of heavy irradiation after months of pain, sleeplessness, lack of appetite, progressive loss of weight, weakness, and care of a foul, sloughing, necrotic area, resulting from a determined effort to cure, through immediate, total destruction of the cancer, does not seem to me to be a desirable alternative.

Because such a large percentage of the patients who reach the radiologist are sent with the diagnosis of inoperable carcinoma, it seems that there should be some effective middle ground between these extremes in roentgen-ray dosage. This has been our belief for many years, and on this is based the methods largely employed at the Memorial Hospital.

To give the impression, however, that we see no value in the heavy doses, or in the prolonged fractionated method, is not our intention, but we do hold that none of them, including our own, should be applied in a routine manner to all cases. It rather appears to us that prolonged fractionated, or better, repeated moderate doses are more scientific in principle than the surgical or mechanical view of immediate total gross destruction through massive doses.

The degree of tumor susceptibility varies to such an extent in certain individuals that the administration of the roentgen-ray dose must be guided by the same principles that are followed by the clinician, who in the treatment of a cardiac lesion or syphilis, to use a rough example, varies the dose of digitalis or the drugs known to be of palliative or curative value as indicated by the response of each individual patient to the medication. The clinician knows with a fair degree of accuracy what the effect of a certain dose of strychnine or digi-

talis will be on the heart and pulse rate. The roentgenologist knows what the effect of a certain exposure to the roentgen-ray will be on the skin and subcutaneous tissues. He knows also that in general, carcinomata are more resistant than sarcomata, but that many exceptions occur in both groups. Cellular, vascular, embryonal tumors, those most malignant from the histological view are most radiosensitive, while avascular tumors composed of adult types of cells, with much connective tissue stroma are generally resistant.

But it frequently happens that the roentgenologist is not supplied with a description of the gross anatomy or histological structure of the tumor, and when this information is lacking and unobtainable, as so often happens, and when it is impossible to determine the vascularity of a tumor and the amount of connective tissue stroma or the character and variety of numerous cellular elements, the radiologist must rely on test doses to determine the degree of radiosensitivity. Heavy doses given to sensitive vascular tumors have been followed by a rapid breaking down of the tumor with death of the patient resulting from toxæmia and hæmorrhage.

I had intended to devote some space to technique, with diagrams showing methods of delivering definite quantities to tumors situated deep in the abdomen or pelvis, and also to discuss the statistics giving results of the roentgen-ray treatment of various groups of tumors. On second thought, however, I decided that the technical or physical side of roentgen-ray therapy would interest only radiologists, and as for statistics, I share the belief with others that they frequently, in cancer work, demonstrate more the lack of knowledge of the disease which exists than our skill in its treatment.

That the surgeon may visualize clearly the present status of deep roentgen-ray therapy, reliable statistics are sought, and would be of inestimable value; but it must be confessed that the statistics which deal with the results of deep roentgen-ray therapy only are not extremely few in number, but in most instances are found to be, on close scrutiny and careful analysis, of but little value. The only statistics of value are those showing results where deep roentgen-ray therapy has been employed along with, or as an adjunct to, radium or surgery, or both. Furthermore, the only statistics comparing irradiation results with straight surgical results in primary operable tumors, deal with carcinoma of the cervix uteri, most of which show the superiority of radium combined with roentgen-ray over surgery.

Those of us who repeatedly see immediate and remote effects of the roentgen-ray on certain types of inoperable and inaccessible tumors find it difficult to restrain our impatience with the delay with which irradiation therapy is accepted as the method of choice in the treatment of certain groups of so called primary operable tumors.

That there is sufficient evidence in the roentgen-ray clinics throughout the country to indicate the superiority of radiation therapy in the treatment of certain groups of tumors is indicated by the case reports which appear in the literature from time to time; and I believe that funds should be obtained by the American Roentgen Ray Society and the American College of Surgeons for the purpose of collecting such data, with the object of having available in time sufficient information from which authentic and reliable statistical reports could be prepared for publication. The American College of Surgeons through the Registry for Bone Tumors has accomplished a piece of educational work which should be a stimulus for similar undertakings along corresponding lines in other fields.

However, I would like to emphasize the fact which is commonly accepted, regardless of the chaotic state in which the question of selection of dosage appears to be, and the lack of reliable statistics, that in the treatment of primary inoperable carcinoma, recurrences, and metastases, no other agent so universally at our disposal offers the degree of palliation obtained through the judicious use of X-rays. The degree of palliation often is difficult to determine, and an opinion can be formed only by a comparison of the patient's condition before and after treatments, often months after, and a thorough knowledge of the character and extent of the process in each given case.

In the treatment of primary operable carcinoma, internists and surgeons who have had

an opportunity of comparing the results obtained through the use of radium or roentgen-rays alone, or combined with surgery, now look upon these agents as occupying a definite and indispensable place. Some radiologists and surgeons like to employ radium for its local destructive effect on the tumor, and surgery later to remove necrotic tissue. Deep roentgen-ray therapy to the tumor, surrounding tissue and lymphatic areas now so frequently precedes and follows this procedure that it appears that those responsible for its use are convinced that the percentage of cures thereby is very definitely increased.

Any advance lately achieved in deep roentgen-ray therapy would hardly have been possible without the co-operation of the manufacturers of the modern X-ray machines and tubes, under the leadership of such scientists as Coolidge. Great credit must also be given to physicists, such as Sheerer, whose untimely death resulted in the loss of one who was looked upon as the leader of this group of non-medical workers whose contributions have been of such great value. Their efforts are largely responsible, not only for numerous improvements in apparatus, measuring instruments, and technique of treatment, but for finally standardizing a method of determining a unit of dosage expressed in terms which mean, regardless of apparatus and tubes, a definite known quantity. Through the efforts of Failla and other physicists, and committees of the roentgen-ray societies, the Bureau of Standards at Washington is able to furnish all roentgen-ray laboratories with the details and specifications required for measuring X-radiation in order to obtain what has been internationally accepted as an amount of radiation designated as the R unit.

But of all those whose help has been of most value, that of a pathologist, Ewing, stands out prominently. Through his observations on the action of radiation on tumors, the medical profession has had its attention directed repeatedly, through numerous publications and lectures, to the possibility of the benefits to be obtained through its use in the treatment of cancer; and it is believed that no other single individual has done as much to aid in the advancement of deep roentgen-ray therapy.

But in spite of the help available, and the knowledge accumulated, it must be confessed that, even among those regarded as authorities, there is still great divergence of views concerning the best methods of employing an agent capable of doing so much good or so much damage. Some of the reasons for this appear to be that frequently those who know most about cancer know least about physics; while those who appear to have a profound knowledge of physics have only an elementary knowledge of neoplastic diseases. Now that it is possible to deliver quite accurately a definite quantity of roentgen-ray to a tumor and its surroundings, regardless of depth and location, and since there is no longer any uncertainty regarding the amount of radiation absorbed by the skin and each succeeding centimeter of tissue beneath it, some roentgenologists who appear to be better physicists than physicians are constantly in search of a fixed dose for certain groups of tumors. There is not, and probably never will be, a standardized carcinoma dose. It may be that some time in the future there will be available some sort of a biological index or guide for the radiologist in the selection of a certain dose, but there is no indication now that such a hope will be realized.

The tangible evidence of the present status of deep roentgen-ray therapy, through which comparison may be made with the past, lies in the development of machines, tubes, and instruments for accurately measuring their output, and the definition of a fixed quantity of radiation known as the R unit, with a consequent improvement in the technique of administering the dose selected. The latest development in this field is the installation of an apparatus at the Memorial Hospital capable of producing X-rays at a voltage close to 1,000,000.

To hold the view or express the opinion that nothing new in radiation effects can be expected through the application of X-rays produced by such an apparatus on the basis that through the use of more penetrating rays of shorter wave length, that is, the γ-rays of radium, clinicians and pathologists have been familiar for years with the changes and effects resulting therefrom, would be unsound and illogical because of the differences in intensity

of the radiation dose possible with such high voltages. Although the radiation produced with such a machine is not as penetrating as the γ-rays of radium, it is considerably more penetrating than radiation produced at 200,000 volts. There is little doubt that the effects of radiation vary with the intensity of the dose. A dose given in 3 days would hardly be expected to produce the effects obtained by the same dose given in 3 hours or in 30 minutes. With this machine it is possible to give a dose in 45 minutes, which with a 4 gram radium element pack requires many hours.

However, to conclude, the success or failure of deep roentgen-ray therapy in each case should be ascribed not so much to the specific action of roentgen-rays as to the judgment exercised by the radiologist in selection of the dose and method of administering it. It is obvious that this judgment results from the knowledge possessed concerning the disease in each patient and the effect of certain doses on such processes, which is obtained largely as a result of experience, and through which comes a realization of one's own limitations and the limitations of deep roentgen-ray therapy.

THE NEWER OUTLOOK UPON CHRONIC ARTHRITIS[1]

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THE subject of arthritis is one which, in some of its phases, is of interest not only to the internist but to surgeons as well and especially to orthopedic surgeons.

I do not know whether you are aware of the extent to which general interest in arthritis has grown. Statistics show that it is the disease constituting the greatest sociologic burden which society bears, even surpassing tuberculosis, but only recently has the public, lay and medical, become cognizant of this fact. Much remains to be done in the way of arousing adequate recognition of the problem of arthritis but it is fair to say that never heretofore has so much attention and effort been directed to it as at the present time.

There are two chief reasons why interest in this subject has grown apace. The first is the demands of insurance agencies that something be done about the ravages from arthritis; the second is the wider angled studies of arthritis, recently going forward, which reveal that the disease is not only of surpassing interest but one for which a great deal can be done. Treatment of arthritics in the past has had to do almost exclusively with the particular lines of training and interest of the given observer and it is not surprising therefore that the results of therapy have been so often disappointing. In order to place before you the light in which the American Committee for the Control of Rheumatism views chronic arthritis, let me here cite briefly part of its concept as to the general nature of this protean disease.

"The Committee conceives of the disease as a generalized disease with joint manifestations. . . . Certain prodromes may be recognized and it is of vital importance that they be recognized. It is the opinion of the Committee that at the present time no single infectious agent or completely defined dietary deficiency or metabolic disorder has been conclusively shown to be the sole cause of these disorders. The Committee inclines to the belief that any one of these factors, or certain combinations of these factors, under appropriate circumstances, may basically underlie the onset of the disease."

I think it important to tell you thus of the views of others who have studied this problem closely, so that you will not feel, that, in what I have to say, I am expressing radical opinions and conclusions of my own.

Let me add at this point that in addition to the interest now being aroused in arthritis, an increasing amount of interest is also being aroused toward the physiology of bone. As

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12-16, 1931.

surgeons you have long given constructive thought to the osseous system of the body but medical men at large, and perhaps internists in particular, have too long regarded the bony skeleton as only a rack on which to hang a few aids to locomotion and even an occasional cloak of ignorance. Modern appreciation of the rôle played by the osseous system emphasizes the fact that this tissue is concerned in fundamental processes of the economy, namely, the blood forming activities and calcium metabolism and that these in turn are conditioned by the anatomical, physiological, and pathological relationships of the particular bones concerned. It seems to me important to stress this point because the questions of bony pathology and calcium metabolism are intimately tied up with the problem of arthritis. Appreciation of the importance of the osseous system makes it easier to understand the necessity for an open-minded approach to the broad problem of rheumatoid disability.

In the limited time at my disposal there will be opportunity to review only hastily some of the essential lines of reasoning which determine our present concept of the disease and the therapy secondary to it. One of the interesting facts which recent studies have brought out is the marked influence of heredity in the production of arthritis. This does not mean that the disease is inherited *per se*, but it does mean that the background upon which the disease is implanted is definitely inherited in about 50 per cent of all cases. On the basis of this, it is not difficult to understand the emphasis which the Boston orthopedists, particularly Osgood, have placed upon the significance of body build in predisposing certain individuals toward arthritis. As will appear later, it is pretty clear that the nervous system is definitely caught up in the mechanism of the disease, and it is, therefore, not surprising to find that fatigue is a factor in etiology; and, by the same token, rest becomes a factor in recovery. This equation has long failed of adequate recognition. Enough has been said perhaps to suggest that the etiology of arthritis is thus varied and not dependent upon one factor, such as focal infection, alone. Emphasis has properly been placed upon focal infection in the production of many forms of disease but it is also plain that its influence has often been overstated and that in any event one must look for the soil and conditions on and under which it becomes operative. The world is peopled with persons harboring abscessed teeth who have neither arthritis nor other demonstrable malady. The influence of infections of various kinds, however, is very clear-cut in precipitating a certain proportion of cases of arthritis. Many organisms can initiate the disease but it is probable that the streptococcus is the most frequent offender though no single strain pre-empts as yet the chief rôle in those cases which are of infectious etiology.

It is necessary at this point to stress the fact that the American Committee for the Control of Rheumatism recognizes two chief varieties of arthritis, namely, atrophic and hypertrophic. The former affects people at or below mid-life and is characterized by destruction of the joint cartilage by overgrowth of a synovial pannus, together with a form of granulation tissue springing from the shaft which destroys the joint cartilage equally from below. The pannus leads to adhesions; these lead to limited motion; and the granulation tissue between the adjacent bones leads to bony ankylosis. The second great variety is hypertrophic arthritis, affecting people mostly beyond mid-life and characterized primarily by a degeneration of the joint cartilage which leaves the bony ends exposed, leading to the high polish from friction of them known as eburnation. True bony union rarely takes place in this type. There is, however, overgrowth of bone at the margins of the joint and the trabeculæ of the shaft and head undergo at the same time a decalcification which leads to deformities from weight bearing and pressure.

Both types of arthritis, however, are definitely systemic in nature and the bony tissues are often caught up only incidentally to the march of the disease as a whole. Many persons who suffer great invalidism from the arthritic syndrome have nevertheless very little true arthritis.

A significant recent advance in our understanding of arthritis springs from an increasing knowledge of the so called dynamic path-

ology; that is to say, the deviations of physiology which are responsible for the actual phenomena of the disease. The interesting chain which investigative work has welded cannot be given in detail. Suffice it that an important fundamental feature of this dynamic pathology is revealed in the fact that arthritics at the periphery show a temperature which runs from 2 to 3 degrees centigrade lower as measured by the thermocouple, than it does in normal persons. The cold hands and feet of arthritics have long been recognized, but the true explanation is only now forthcoming. Exposure of arthritics to environmental cold shows that whereas the initial peripheral temperature is lower, the subsequent fall of temperature is also less. Upon the return of the subject to room temperature, the rise of the lowered peripheral temperature is also slower and less than with normals. This constitutes a condition approaching rigidity of the finer vascular system of the periphery because it is known that, other things being equal, the temperature in a part is a function of the blood flow through it. Again, direct observation of the capillaries under the microscope shows them to be more or less closed, or at least empty, in the arthritic. Measures which benefit the patient subjectively, such as heat, massage, exercise, coffee, aspirin, and the like, are seen to open up these capillary beds and to induce a blood flow approximating normality. Again, if the red cell count of the periphery be meticulously observed, there will be found a difference, namely, a lowered count, in the blood first issuing as compared with later issuing blood. This is the reverse of the normal relationship. It thus appears that the rheumatoid syndrome is accompanied by a disturbance of peripheral blood flow in the finer vessels suggestive of vasoconstriction. It should, therefore, be possible to induce something of the phenomena of arthritis by experimental interference with the blood flow in laboratory animals. This has, indeed, proved to be the case and by ligating the vessels of the patella in dogs, marked bony overgrowth can be induced in periods varying from 4 to 9 months, as the work of Wollenberg and of the writer and his associates has shown. Attention should also be called to the influence of sympathectomy, as advocated by the Mayo Clinic, for a small number of cases. This further illustrates the involvement of the nervous system in production of the disease, already recognized in the Charcot joints of tabes and syringomyelia.

Attention must now be turned to another series of observations bearing at once on etiology, pathology, and therapy. The writer has recognized for many years the relation of certain gastro-intestinal deviations, as determined by the X-ray, as well as the importance of dietetics to many cases of the arthritic syndrome. Recent work of Rowlands and others has shown that these gastro-intestinal deviations can be closely simulated in dogs fed upon a certain ration low in vitamin B and accompanied by a large intake of carbohydrate. Furthermore, these deviations return toward normal with correction of the dietary. These abnormalities exist equally in both types of arthritis among humans, and Fletcher has recently shown that with correction of the dietary the abnormal X-ray picture in them returns toward or to normal, precisely as it does in experimental animals. The deviations in the gastro-intestinal tract are in the direction of elongation, dilatation, reduplication of the bowel, achlorhydria, lethargy of the gall bladder, and even general visceroptosis. In this situation can be seen some of the influence of faulty body posture which, itself, induces or permits mal-position of the thoracic and abdominal viscera. Faulty body posture also results from such mal position and so contributes to a vicious cycle. There is here obviously a series of observations whose philosophic and therapeutic implications are far reaching. It may be said that the hitherto current, and sometimes narrow, conception of the etiology of arthritis becomes merged in a wider outlook of significance basal not only to arthritis but to many associated conditions as well; e. g., to dogmatize as to the exclusive domination of focal infection in this field, in the ordinary sense of the word, is to fail to see the problem whole and, above all, to fail to bring to bear proper therapy.

Observations complementary to the aforementioned lines of reasoning are to be seen,

as already remarked, in the newer studies relating to the field of physical therapy. Explanation of the value of massage, heat, and exercise, appreciated by arthritics for thousands of years, is to be seen in the influence which these exert upon the vascular bed. The corollary is, of course, equally that a disturbance of this vascular bed constitutes part of the physiological deviation in arthritis.

Arthritis thus becomes therefore a wide syndrome dependent upon deviations of physiology expressing themselves in many or all tissues of the body; these dependent in turn upon a large number of prodromal and precipitating influences. To expect to influence this varied syndrome by any one measure of therapy, be it operative, physiotherapeutic, a drug or a vaccine, must appear unphilosophical and clinically inadequate to any dispassionate observer. It should be obvious, almost by definition, that only an angle of vision subtending these component factors can be expected to influence the situation as a whole in any large series of cases. This is, indeed, the fact and it is primarily the purpose of the American Committee for the Control of Rheumatism to endeavor to educate the profession as a whole to the importance of this outlook.

There is, of course, no opportunity here to enter into the details of the many factors contributing to the intelligent therapy of arthritis. Such therapy depends upon visualization of the hereditary background, the frequently faulty posture, the usually fatigued subject, the precipitating or aggravating influences of localized infections, the almost indefinite opportunities for toxæmia from the gastro-intestinal tract, the particular disturbances of the soft tissues in the way of anoxæmia, the correction of these by means of intelligent physical therapy, the institution of a proper dietary, and of better function of the various parts of the gastro-intestinal tract as a whole.

A balanced dietary in which the vitamins are high and the calories are yielded largely by fat and by protein is probably desirable in nearly all arthritics. In properly selected cases it becomes necessary to curtail the whole caloric intake in addition and to curtail the energy output proportionately by rest in bed. Postural rehabilitation becomes of great importance and the distressing deformities which the profession has too often permitted are no longer to be excused.

The approach to the treatment of each type of arthritis is, in the minds of many observers, much the same with the exception of the fact that in individuals under mid-life, who are mostly of the atrophic type, infection may cause greater systemic damage. Infection is apparently also operative, though better resisted, in the older subjects of arthritis, hypertrophic in type, and may not then require such surgical radicalism. There are other minor differences which there is not time to relate but one leading therapeutic corollary to division of arthritics into two great groups, is the fact that in the atrophic variety some motion, by the subject, of the part involved is useful to delay or prevent the bony ankylosis which otherwise may arise. Rest to a hypertrophic joint can be indulged more freely. Rest to the individual as a whole, however, is essential in both types in a high proportion of cases and often constitutes the *sine qua non* upon which every other form of therapy must depend.

There is nothing in these remarks to justify neglect of the important influence of focal infections of all kinds. The situation is rather one in which the influence of these factors is seen to be only part of the problem and often secondary to it. Indeed, it is clear that focal infection often arises in consequence of the deviations in the physiology of the tissues referred to, by virtue of which they become easily invaded by bacteria. Focal infection which thus arises may then, of course, become a cause as well as a result. In suitably studied cases, vaccine therapy may be appropriate and necessary, but in fairness to arthritics it should be given only the emphasis it deserves. Too many lucrative practices have been built up upon the supposed specificity of organism A or B toward the varied syndrome which suffering arthritics present. By the same token no drugs deserve to be stressed as a solution of this problem. If any are to be mentioned let them be arsenic, for its influence upon the secondary anæmia so commonly encountered; and the salicylates, to meet emergencies only.

The treatment of cough in tuberculosis rests upon a balanced physiological program and not upon opiates. By the same token the treatment of pain in arthritis should depend upon correction of the faulty physiology locally and systemically and not upon masking it by analgesics. Commercial houses reap a harvest through their sale of drugs to physicians who are too busy, and, unfortunately, sometimes too indifferent, to study the pathological background of their patients.

The physiological lesson is hard to learn and truth dependent on it spreads slowly. Arthritis cannot be treated with a syringe alone and the physician who does not appreciate this, may resemble the uniformed employee at a gas station, knowing one duty only.

What can we do to expedite extension of knowledge of this great syndrome which claims more sufferers and exacts a greater economic burden than does any other disease in the whole gamut of medicine. The American Committee is already doing its utmost and is encouraged greatly by the interest it has apparently aroused; but to teach is not necessarily to be taught. Even golf cannot be learned through a correspondence course and the profession must be prepared to give to arthritis some of the effort it must usually devote to a mashie shot. There is no gainsaying the necessity of learning more concerning arthritis through investigative work. There is equally, however, no gainsaying the fact that a crying need of the hour is for the profession to learn more of what is already known concerning this disease. If available knowledge could at once be brought to bear on the treatment of existing sufferers, the problem as a whole would probably be reduced about 60 per cent. Statistics show that in a properly run clinic, great betterment or cure can be achieved in about 75 per cent of all cases. These results are available to anyone who will take the time to train himself in the problem. Until the profession does so train itself, however, the public will continue to be exploited by "quick cures" and irregular practitioners. Arthritis has afforded one of the citadels of quackery but the way is open to carry the fort by storm and rescue its captives whenever the profession girds up its loins and determines so to do.

PERITONEAL ADHESIONS

Their Prevention by the Use of Digestive Ferments[1]

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POSTOPERATIVE peritoneal adhesions often occur as undesirable sequelæ to mar the outcome of an otherwise successful abdominal operation. The serous membranes, including the pleura, pericardium, and peritoneum, are unique in their ability to form adhesions. Such adhesions are not always deleterious, but, on the contrary, the formation of adhesions between two serous surfaces is essentially a protective process. If the peritoneum did not possess this phenomenal property, present day abdominal surgery would be hardly possible, the gastro-intestinal canal could not be opened without a disastrously high mortality, and every perforation of abdominal viscera would probably prove fatal. The value of the protective power of the peritoneum is exemplified by the high mortality associated with operations on the thoracic portion of the digestive system, the œsophagus, which is not covered by a serous membrane. Adhesions may at times, however, after they have served their period of usefulness, persist to the detriment of the patient. It is with this group of adhesions that the present communication is concerned.

The subject of peritoneal adhesions is of especial importance to abdominal surgeons. During the course of every intraperitoneal operation, the surgeon must understand and constantly consider the reaction of the peritoneum to mechanical, chemical, and bacterial trauma. He must be able to enlist the aid of this peculiar property of the peritoneum for the benefit of the patient and must concomitantly avoid the occurrence of its deleterious effects. The surgeon must remember the remarkable protective attributes of the untraumatized peritoneum and so gentle must be his manipulations that the delicate endothelial cells which form a part of the peritoneum are not disturbed. As Deaver has so aptly said, "The responsible factor for the development of acquired adhesions is, in a word, the peritoneum under distress." The surgeon should not be guilty of unnecessarily causing distress to the peritoneum. The peritoneum is an extensive, complex membrane, which Wegner calculated had an area almost equal to the total surface of the body. It is lined over its entire surface with a layer of endothelium. As shown by Graser, the endothelial cells are easily injured by mechanical, chemical, and bacterial trauma, but, as long as they remain intact, no adhesions can occur. Endothelial cells also possess the property of marked regeneration and adhesion formation following destruction.

The reaction of serous membranes to various micro-organisms differs considerably. The peritoneal reaction caused by streptococci is characteristic in that the peritoneal fluid contains relatively few leucocytes and a small amount of fibrin, which is present in flakes. Streptococcic infections of the peritoneum show little tendency to become localized. The peritoneal reaction to infections with the colon bacillus is entirely different in that the exudate is rich in fibrin and contains many leucocytes. This undoubtedly accounts for the fact that in the presence of extremely virulent organisms, especially streptococci, adhesions do not form as frequently as in other types of infection. Boyd states that when the peritoneal inflammation is more acute and virulent in character, the exudate is cellular, no fibrin is formed, and adhesions are absent. Adhesions forming as a response to peritoneal trauma are, however, usually temporary and generally become absorbed after the inflammatory process has subsided. This is the result of the proteolytic enzyme which is liberated from the polymorphonuclear leucocytes as they are destroyed. Almost any chemical irritant, unless it is so corrosive that it is grossly destructive, may cause the formation of adhesions. Iodine and iodoform, the former used as a skin antiseptic, the latter frequently employed to

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impregnate gauze tampons, have long since been the peritoneum's prime offenders. Mechanical violence sufficient to cause the formation of adhesions is usually the result of the injudicious activity of the surgeon.

Almost immediately after injury of the peritoneum, there occurs an inflammatory reaction and a layer of fibrin forms over the involved peritoneal surface. Graser, because of his microscopic studies, states that fibrin is not deposited unless the endothelial cells have been injured. He believes that in each instance there has been an interference with the blood supply to the endothelial cells. The fibrin is derived from the plasma of the blood to which, from the injured cell, is added a ferment, thrombokinase, permitting the fibrinogen to be deposited as fibrin. The fibrinous exudate may cover the uninjured endothelium as well as those areas in which the endothelium is traumatized. In the very early stages of this inflammatory reaction, there is a serous effusion containing a large number of phagocytic neutrophils. Hertzler found that the cells in the exudate are largely mononuclear but that a few polymorphonuclear leucocytes also occur. In the absence of infection, the mononuclear leucocytes on the surface become flattened and ultimately become the endothelial cells covering the peritoneal defect. Endothelialization begins and progresses in all parts of the area at once and does not extend from the periphery as in the case of the skin. In the presence of infection, Hertzler has shown that fibrin is not formed until the infection is combated which process usually lasts from 3 to 10 days. The neutrophilic leucocytes produce a strong proteolytic ferment which Opie calls leucoprotease and designates as being trypsin-like. The fibrinous layer serves to protect the endothelium from toxins and enables the intestinal surfaces to adhere, thus mechanically limiting the spread of infection (MacCallum). When two injured serous surfaces are placed in apposition, adhesions between them are certain to form unless artificially prevented. Adhesions form with surprising rapidity. Hertzler, in his investigations, was able to demonstrate fibrinous fibers within 10 minutes after intestinal suture. After 30 minutes, the fibrinous bundles were fully formed and the process was complete within 2 hours. Gross (1843) showed that the intestines of dogs became extensively adherent within a few hours after trauma. Senn (1888) demonstrated that firm adhesions formed between peritoneal surfaces in from 6 to 12 hours. In the presence of trauma, however, these adhesions formed more rapidly. Heinz found that the intraperitoneal injection of Lugol's solution caused agglutination of the intestines within 12 hours and that by 18 hours, these adhesions had considerable strength. The adhesions, fibrinous at first, in many individuals rapidly become converted into fibrous tissue and become covered with endothelium. However, in the majority of instances owing to the tryptic ferment produced by the destruction of the leucocytes, the fibrinous adhesions become digested before organization takes place. Hertzler showed that from the third to the fifth day, from the characteristic staining obtained with Mallory's stain, there is evidence of fibrous tissue formation. He is of the opinion that this change from fibrin to fibrous tissue can occur without actual contact with cells. Those adhesions which become replaced by fibrous tissue persist, although Hertzler has shown that the embryonic fibrous tissue can be digested by pancreatin similarly as fibrin is digested. However, after adult fibrous tissue has been laid down, no digestion is possible. The fate of the permanent fibrous tissue adhesions varies considerably in different individuals. As a rule, these adhesions will become stretched to form long strings or may be thinned by traction of the moving gut and abdominal wall until they are veil-like webs. If the process which gave rise to the adhesions was an infection, the adhesions, like scars formed as a result of infection, are prone to stretch. That all adhesions do not become replaced by fibrous tissue is evidenced by the fact that not infrequently, a peritoneal cavity which is known to contain numerous fibrinous peritoneal adhesions may at a second laparotomy be found to be entirely free.

It has been the experience of all surgeons that occasionally a patient will be encountered in whom, in spite of all precautions which are taken to prevent the formation of adhesions,

such adhesions do occur. Undoubtedly, in such an individual there exists an unusual tendency to form fibrous tissue. We have observed that almost invariably associated with the peritoneal fibrous adhesions there is also a keloid of the abdominal scar so that we have come to consider these individuals as those with a "keloid diathesis" because of the peculiar inherent tendency for the development of fibrous tissue. The idea of constitutional predisposition to adhesions is not new. Payr is of the opinion that persistent fibrous adhesions are especially apt to occur in a certain class of individuals; i.e., those with a lymphatic and asthenic habitus. C. Vogel concurs in this opinion. Lindig believes that there is an inherited predisposition for the pelvic peritoneum to develop adhesions because he has found more adhesions in the pelvis than elsewhere in the body. Undoubtedly, this is due to the fact that inflammatory processes are more apt to occur in this region than in other parts of the peritoneal cavity. Almost every surgeon has had at least one patient who repeatedly develops and redevelops multiple, permanent, fibrous adhesions. Flesch-Thebesius reports a case in which it was necessary to operate twenty-three times because of the repeated formation of adhesions. Such a patient may be rightfully said to have a "keloid tendency" or an "adhesions diathesis."

Because fibrous adhesions are the end products of fibrinous adhesions, it is obvious that if adhesions are to be avoided with certainty, prevention must consist either of prophylaxis against the primary occurrence of the fibrinous exudate or the destruction of this fibrin before organization occurs and true fibrous adhesions are formed. As has been stated, the fibrinous exudate is beneficial even to the point of being actually life-saving. The fibrous adhesions which form secondarily may, however, be undesirable and give rise to dangerous complications. Peritoneal adhesions follow hernia in frequency as a cause of intestinal obstruction. In a series of 569 laparotomies reported by Klotz, 31 patients (5.5 per cent) developed an ileus subsequently, of which number 5 died. Payr reports that in a series of 3,000 laparotomies, subsequent operations were necessary because of peritoneal adhesions in 98 (3.26 per cent). In addition, 65 cases with peritoneal adhesions, which had not previously been operated upon, required laparotomies. Of the whole group in which laparotomy had been performed, from 10 per cent to 12 per cent required no operative therapy. Payr is of the opinion that from 12 per cent to 15 per cent of patients in whom a laparotomy is performed, subsequently will develop symptoms due to adhesions. Intestinal obstruction may occur years after a patient has recovered from peritonitis. Pericholecystic adhesions may remain for years as evidence of acute cholecystitis or empyema of the gall bladder, and may give rise to obstructive jaundice or duodenal stasis. Adhesions which primarily serve to localize an acute pelvic infection may persist to cause obstruction of the fallopian tubes or sigmoid. If chronic symptoms referable to these undesirable adhesions occur, the surgeon hesitates to advise surgical division of the adhesions as he realizes that the incidence of the reformation of adhesions is high, especially in those individuals who have a "keloid tendency." Frequently, however, the operation becomes imperative because of ileus. When these fibrous adhesions are divided, fibrin immediately forms over every cut surface. It becomes organized later to form more fibrous adhesions. In spite of every precaution in these individuals, there is almost invariably a recurrence of the adhesions, necessitating repeated operations until the patient ultimately dies of intestinal obstruction. As Hertzler states, "this sequence lasts as long as the patient does, or the hopeful persistence of the surgeon endures." The necessity and desirability of preventing the reformation of adhesions in this type of case becomes self-evident. However, these secondary recurrent adhesions present a difficult surgical problem.

Even though any type of trauma may be responsible for the development of peritoneal adhesions, as a rule, infections are responsible for the majority of cases. Infection should not follow clean surgical cases and there should be no need to enlist the peritoneum in its defensive powers because of the occurrence of contamination. Strict asepsis will serve to prevent the

peritoneum's reaction to various bacterial trauma. Antiseptics and other chemicals should not be used injudiciously in the proximity of the peritoneal cavity. Allowing the viscera to touch the skin painted with iodine, picric acid, etc., should be carefully avoided. Likewise, gloves washed in antiseptics should not touch the peritoneum until they have been carefully washed with sterile water. Pouring antiseptic solutions into the peritoneal cavity has long been discontinued because of the uniformly undesirable results. Mechanical trauma inflicted by the surgeon is an outstanding, partially avoidable, cause of postoperative adhesions. The surgeon must constantly respect the delicate endothelial layers of the peritoneum. Rough handling is not permissible at any time. Care should be exercised in the use of gauze packs in order to minimize the amount of trauma. Forced retraction of the viscera should be avoided as well as the clumsy handling and slipping of the retractors on the abdominal wall. During the course of the operation, care should be taken to prevent the peritoneal surfaces from coming in contact with the air. Walthard, as early as 1893, showed experimentally that exposure of the peritoneum to the air for periods of time with subsequent fixation of the two peritoneal surfaces invariably resulted in the formation of adhesions. He proved that the dehydration was the cause of the peritoneal injury as it could be prevented by the use of moist compresses. For a period of time following this, there was considerable controversy among authorities concerning the use of dry or moist packs in the peritoneal cavity. Whereas the latter is probably to be preferred, in reality it makes relatively little difference because if each is used properly, there results relatively little injury to the endothelial cells of the peritoneum. However, packs moistened in warm normal saline solution and changed frequently in order to prevent cooling of the viscera protect the peritoneum better than dry packs.

The presence of blood in the peritoneal cavity has been considered by many as a cause of peritoneal adhesions. The fact, however, that blood may be given intraperitoneally without the development of adhesions is proof that blood *per se* does not predispose to adhesions. However, in the presence of trauma as shown by the researches of C. Vogel, blood does favor adhesion formation. Apparently, there is liberated from the injured endothelial cells thrombokinase which is responsible for the coagulation of the blood and the deposition of fibrin. It is, therefore, desirable as advocated by Klotz, Ward, and others to remove all blood from the peritoneal cavity following an operation. Richarz denies that blood predisposes to the development of adhesions. Nevertheless, careful hæmostasis is of paramount importance.

It becomes obvious, therefore, that the abdominal surgeon should observe careful technique and strict asepsis, should avoid trauma, and minimize handling and exposure of viscera. Many adjuncts have been recommended to aid in the minimization of trauma. Gellhorn and Coffey advocate the use of large sheets of thin rubber for abdominal packs instead of the usual gauze compresses. The avoidance of all foreign materials, drains, etc., whenever possible is essential in order to prevent continued trauma. It is a well known fact that a foreign body introduced into the peritoneal cavity will immediately become walled off by fibrinous adhesions which ultimately become organized and are replaced by fibrous tissue. The use of the cautery in order to prevent the reformation of adhesions has been recommended by many authors. Spiegelberg and Waldeyer found that cautery did not prevent adhesions. Dembowski experimentally showed that cauterization of the peritoneum resulted in the production of strong adhesions. Opposite results were obtained by Kelterborn and Kuestner. K. Vogel showed that if the cauterization were superficial, adhesions resulted whereas if deep no adhesions occurred. K. Franz showed experimentally that cauterization produced more extensive adhesions than did extirpation of the peritoneum in other ways. Maslowski was unable to find that cauterization prevented adhesions.

By far the most efficient method of preventing peritoneal adhesions is a careful peritonealization of all denuded areas. This is accomplished by careful approximation of free peritoneal edges in order that there are no areas devoid of peritoneum. Unfortunately

not infrequently defects produced either at the primary operation or as a result of division of adhesions are so great that the edges of the peritoneum cannot be approximated. In such a case, some other means must be used to cover these denuded areas. Nicholas Senn (1888) in an exhaustive experimental investigation, showed that an omental graft would successfully prevent the formation of adhesions along peritoneal suture lines. Similar results have been obtained by Grigolaff, Iselin, Freeman, Chislett, Sweet, et al., with isolated omental grafts. On the other hand, Kolaczek's and Mann's experimental results have been unsatisfactory with the use of free peritoneal grafts. Mann found that if the omentum were not used as a free graft but if the intact omentum were used adhesions could be prevented. Springer is of the same opinion, i.e., there is little or no need for the use of free transplants of omentum because as a rule, the omentum can be placed in any part of the abdomen and that the results obtained will be better than if a free transplant is used. It is a well known fact that the omentum does protect a denuded area by the formation of adhesions between the omentum and the denuded area. Such adhesions may be of no consequence, provided there is no disturbance with the intra-abdominal physiology. However, it is possible that such adhesions, especially if they are in the pelvis, may produce marked disturbances in the motility of the stomach and transverse colon. Clark and Byford advise against the use of the intact omentum to cover defects in the pelvis because these adhesions may produce disturbances in the motility of the stomach and transverse colon. Thompson showed that the spreading of the omentum behind the abdominal wall prevented adhesions between the suture line in the abdominal wall and the intestines. Dunsmoore has also emphasized the importance of the omentum in preventing peritoneal adhesions. Amann recommended obtaining peritoneal flaps from the anterior half of the pelvis to cover denuded areas. Free peritoneal flaps were also used by Lowey. Richardson mobilized a peritoneal flap from one leaf of the mesentery in order to cover peritoneal defects of the intestine.

In those instances in which peritoneal membranes are not available for use, a number of foreign substances have been used. Baum, in 1894, attempted to prevent the formation of peritoneal adhesions in animals by the use of various substances. He employed a cloth made of woven catgut, fish bladder, and the peritoneum from a young calf, taken immediately after butchering. He was able to prevent the formation of adhesions in a fairly large number of instances, both experimentally and clinically. Morris, acting on a suggestion made by Cargile, employed sterilized oxen peritoneum in an attempt to prevent the formation of adhesions. Morris's experimental investigations with the use of the membrane, which he named after Cargile, were unsatisfactory. However, his clinical results were not as disappointing as those obtained with animals. This, Morris thought, was due to the fact that adhesions are much more apt to occur in dogs than in humans. Freeman condemns the use of Cargile membrane on the basis that it acts as a foreign body and causes more adhesions. Craig and Ellis found that the use of Cargile membrane intraperitoneally acted as a foreign body and did not prevent the reformation of adhesions. Williamson and Mann, in an investigative study employing various substances, found that Cargile membrane did not prevent the formation of adhesions. Oiled silk has been used by Lauenstein, Paton, Williamson and Mann in an attempt to prevent the formation of adhesions between two denuded surfaces of the peritoneum. In each instance, however, the results were unsatisfactory, as one can easily imagine. Puls believes that focal infection may play a great rôle in the development of adhesions in that as a result of the local lowering of resistance, bacteria which are present in the circulating blood may be able to set up an inflammatory process. He, therefore, advocates the use of silver foil to cover denuded areas of the peritoneum. He believes that silver foil not only prevents denuded surfaces from coming in contact with each other but also that it exerts antiseptic properties. Williamson and Mann, however, in their experimental work, obtained negative results with silver foil. Duschinsky employed goldbeater's skin unsuccessfully in

the treatment of adhesions. Lyman and Bergfeld advocated the use of amniotic membrane as a covering of denuded areas of peritoneum.

Other substances have been introduced into the peritoneal cavity with the idea of not only covering the denuded area but also of furnishing a lubricant so that the denuded areas might glide more readily over one another. Sterile olive oil has been employed by a large number of investigators. Martin first advocated covering denuded areas with olive oil in order to prevent the reformation of adhesions. Claypool, et al., experimentally, and Crump, clinically, obtained good results with olive oil. Blake's results were not uniformly satisfactory. In the hands of other investigators, Stern, Busch and Bibergeil, Schelpelmann, Pope, Kubota and Williamson and Mann, olive oil proved to be of no value in preventing adhesions. Busch and Bibergeil found that it produced a distinct irritation to the peritoneum. Claypool, Vance, Robertson and Field found that whereas olive oil was successful in preventing adhesions, liquid petrolatum exerted no such effect. Their findings are corroborated by experimental investigations of Busch and Bibergeil, Pope, Sweet, Chaney and Wilson, Walker and Ferguson, Williamson and Mann. Wilkie employed sterile vaseline oil and felt fewer adhesions resulted because of its use. The use of camphorated oil in the peritoneal cavity was first recommended by Hirschel in 1907, who believed that 1 per cent camphorated oil was of value in combating an infection of the peritoneum but also in decreasing the incidence of adhesions. Its use was recommended by Pfannenstiehl and Hoehne and Seuffert. Schepelmann found experimentally that the use of camphor in oil did not prevent the formation of adhesions. Ruebsamen observed a case in which the intraperitoneal injection of 170 grams of camphor in oil produced a fatal collapse. Lanolin was used experimentally by Busch and Bibergeil and Williamson and Mann with negative results. The combination of lanolin and paraffin was equally disappointing. Chislett advocated, if it were impossible to cover the denuded areas with peritoneum, the use of sterile omental oil. Crump advocated using an oil expressed from the omentum of an ox. Loehnberg and Eden and Lindig used humanol successfully in the prevention of adhesions. The latter authors found that homogeneous were better than heterogeneous oils. Loehnberg, on the other hand, found that humanol was more efficacious in preventing adhesions in animals than oil obtained from the animal because of its lower melting point (the melting point being nearer that of body temperature). Heuss obtained no results from the use of humanol. The use of oils in order to prevent the formation of adhesions has been very disappointing as is evidenced by clinical and experimental investigations.

Other substances, because they form an impervious covering over the denuded areas of peritoneum or furnish a mucoid material which will serve as a lubricant, allowing the endothelial surfaces to glide easily past one another, have been employed. C. Vogel recommends the use of gum arabic as a covering for the denuded areas and obtained very satisfactory results both from its experimental and clinical use. Busch and Bibergeil experimentally were unable to corroborate Vogel's findings. Kuehl warns against the use of gum arabic because of the danger of tetanus developing as sterility is difficult. Morris advised covering the injured surfaces with aristol which coagulates the lymph and forms a protective covering. Williamson and Mann employed a combination of gelatin and gum acacia and believe from their experimental results that the number of adhesions which formed postoperatively were decreased. It was the only substance that was of value in their hands. Busch and Bibergeil found that agar and gelatin or carragen solution (island moss dissolved in physiologic salt solution) did not prevent the formation of adhesions. Collodion failed completely in Duschinsky's hands. C. Vogel experimented with mucin but because of its rapid decomposition, warns against its use in humans. Kocher employed peptonized milk intraperitoneally because he had observed that the mucoid-like contents of chylous cysts seemed to prevent adhesions. Pope, experimentally, found that neither peptonized nor raw milk was of any value. Egg albumen either alone or that to which citrate is added, was ineffectual in preventing adhe-

sions in Pope's hands. Pribram advocated the use of the vitreous humor of calves' eyes and was successful experimentally in preventing the formation of adhesions by means of this substance.

Attempts have been made to keep the injured peritoneal surfaces separated until the denuded areas have become covered with normal peritoneum. Mueller (76) in 1886 advocated the introduction into the peritoneal cavity of large quantities of normal saline before the abdomen is closed. In this way he believed that the injured peritoneal surfaces would be separated and no adhesions would result. Others have used the procedure successfully (Malcolm, Winiwarter, Duschinsky, Ward, and Reichelderfer). Martin is of the opinion that the intraperitoneal injection of saline acts as a foreign body whereas Stern, C. Vogel, Pope, and Puls found that it was of no value in the prevention of peritoneal adhesions. Bainbridge and Feldmann advocated the introduction of oxygen into the peritoneal cavity in order to prevent the omentum and loops of gut from adhering to the abdominal wall. Kelterborn, on the other hand, believes that adhesions between the omentum and the anterior abdominal wall are the result of air left in the abdominal cavity which presses the omentum against the suture line.

In order to replace the viscera in their normal position and prevent denuded areas from becoming adherent, Gellhorn advocates the introduction of a large enema at the close of the operation which distends the large bowel and avoids its subsequent kinking by adhesions. Cleveland and Ward accomplished the same results by inflating the gut with oxygen. Werth recommends filling the urinary bladder with boric solution for a few hours after operation in order to prevent the formation of adhesions in the cul-de-sac of Douglas.

As peritoneal adhesions are originally fibrinous, the fibrin being derived from the plasma of the blood, attempts have been made to prevent the deposition of or decrease the amount of fibrin which is deposited. Marvel employed a saline solution containing adrenalin believing that the oozing from the denuded areas would be decreased and that the absorption of the blood from the peritoneal cavity would be increased. C. Vogel attempted to prevent the formation of the fibrinous adhesions by introducing into the peritoneal cavity a citrate solution. He combined sodium citrate with gum arabic and reports good results from their use. Henschen had previously used citrate and found that it was not injurious to the peritoneum. Pope, in an extensive experimental investigation in which a large number of solutions were used, found that a solution of 2 per cent sodium citrate and 3 per cent sodium chloride prevented the development of adhesions. Similar but less definite results were obtained with ammonium oxalate. He later reported the results obtained with the citrate solution in 400 clinical cases. Sweet, Chaney, and Willson, from their experimental results, feel that citrate solution is not indicated in cases in which infection is present but it may be indicated in those cases in which infection can certainly be excluded. Because of the good results which he had obtained with sodium citrate, K. Vogel suggested that hirudin, which is an extract of leeches, might be used to prevent the deposition of fibrin. F. Franz previously had shown that hirudin prevented coagulation of blood. Schmiedt showed experimentally that hirudin would prevent the formation of adhesions. K. Vogel and Schmiedt injected magnesium sulphate intraperitoneally, in from 5 to 20 per cent solutions without success. Hertzler attempted with some degree of success to prevent the deposition of fibrin by the oral administration of phosphorus which destroys the fibrinogen. He also employed peptone hypodermically whereas K. Vogel employed it intraperitoneally, however with only inconstant results.

Repeated attempts have been made to employ some drug which would have a specific effect upon already existing adhesions. Eastman used iodides in the form of syrup of hydriodic acid because of a supposed direct inhibition of the proliferation of connective tissue. Thiosinamine has been used with negative results by Offergeld, Michael, Busch and Bibergeil, and Sidorenko. Busch and Bibergeil employed fibrolysin intraperitoneally and found that it was absorbed too rapidly to be of any value.

In 1877, Wegner injected into the abdomen liquids of high diosomotic equivalent and found that in one hour, the amount of fluid equal to from 4 per cent to 8 per cent of the weight of the animal was secreted. The solution originally employed was a hypertonic sodium chloride solution. Kuehn suggested using glucose instead of salt and recommended the use of a hypertonic solution in peritonitis. Reschke also studied the effect of hypertonic glucose solutions intraperitoneally. Pope found that hypertonic solutions of glucose exerted no effect on the prevention of adhesions. Narat was of the opinion that the intra-abdominal injection of hypertonic glucose solution was of benefit in peritonitis. More recently, Buchbinder has shown experimentally that hypertonic dextrose solutions tend to prevent peritoneal adhesions and encapsulation. He found that this solution produced a transudate which when present in large amounts prevented fibrin formation and thereby facilitated drainage and prevented adhesions between the loops of bowel.

Stimulation of peristalsis in order to keep the intestine in constant motion and thus prevent the formation of adhesions has been employed by many surgeons. K. Vogel recommends the hypodermic use of physostigmine, after operation. Similar good results are reported by Tait, Prima, Cumston, Hippel, Paton, and Gelinsky. Klotz advocates the administration of 50 grams of castor oil. Tinker emphasizes the importance of thorough pre-operative evacuation of the intestinal tract; postoperatively, he employs eserine and strychnine to stimulate peristalsis. Uyeno has observed no results from the use of increasing peristalsis by means of physostigmine and Coffey is of the opinion that cathartics do more harm than good following operation. Hertzler, in discussing the use of catharsis, states, "Denuded surfaces will not glide over each other except by direct mechanical force. Attachment takes place before the nurse can fill the hypodermic for the first dose." That forceful movements will not prevent the reformation of adhesions is exemplified by the researches of Ochsner and Herrmann, in which it was shown that experimentally produced pericardial adhesions invariably reform following division of the adhesions in spite of the fact that the heart is in constant motion. Undoubtedly, the motion in itself is responsible for the formation of the adhesions in that mechanical trauma is maintained.

A more physiologic method of increasing peristalsis consists of the application of heat to the abdomen which is advocated and practiced by many surgeons. Gellhorn recommended the application of dry heat to the abdomen, which procedure has been used successfully by Strempel, Stavely, Gelinsky, K. Vogel, and Ochsner. In order to stimulate peristalsis, many surgeons advocate the institution of early movement postoperatively. Ward believes that, if the patient is allowed to get out of bed shortly after operation, any fresh adhesions may possibly be broken by such movements. K. Vogel employed abdominal massage, early change in position, and later abdominal gymnastics. Uyeno showed experimentally that massage of the abdominal wall was of value in preventing adhesions. Loehnberg warns against abdominal massage, however, because of the danger of increasing exudation in the operative area. Early movement in bed is advocated by Reichelderfer, Ward, Henle, Rohde, and Prima. In order to prevent adhesions, Tinker advocated placing the patient in such a position that the viscera will fall away from the operative area, i.e., following pelvic operations, the foot of the bed is elevated and following upper abdominal operations, the head is raised. Similar procedures have been used by Byford and Payr. The value of early movement of the patient cannot be overemphasized, not primarily because of the effect it may have upon the development of adhesions but because of the minimization of other postoperative complications, especially those involving the pulmonary and vascular systems.

Johnson, in 1927, reported his observations on the use of amniotic fluid in the prevention of peritoneal adhesions. His conclusions, after his preliminary work, were favorable, inasmuch as he was able to prevent adhesions in 80 per cent of his cases. Warren elaborated on this work and out of a series of 97 investigations had few or no adhesions in 78 and moderate or dense adhesions in 19. Trusler, in a

recent investigation, found that amniotic fluid concentrate produced no or slight adhesions in 138 of 396 guinea pig experiments whereas either moderate or dense adhesions resulted in 215 of the same number. In 22 dogs, no or few adhesions occurred in 15 and moderate or dense adhesions were found in 6, following trauma to the peritoneum and the administration of amniotic fluid concentrate. Trusler is of the opinion that the amniotic fluid accelerates healing and epithelization and believes that it is of value even in the presence of infection of the peritoneum although this latter conclusion is based upon an observation of only 10 animals. Lacey repeated the work of Johnson and Warren, but was unable to duplicate their good results. He could only conclude that amniotic fluid was apparently harmless when introduced into the peritoneal cavity, but it could not be depended upon to prevent adhesions although it possibly did modify their density.

A number of investigations have been made concerning the efficacy of digestive ferments in combating the formation of peritoneal adhesions. Theoretically at least the use of digestive ferments is rational in that the enzymes digest the fibrin which is first produced as a result of peritoneal trauma before it becomes organized. Payr, in 1922, advocated the use of pepsin Pregl iodine solution in the peritoneal cavity in order to prevent adhesions. The pepsin served as a digestant and Pregl's isotonic iodine solution was added to it in order to sterilize the ferment. Frankenthal found experimentally that pepsin Pregl iodine solution prevented the formation of peritoneal adhesions and was absorbed from the peritoneal cavity within from 6 to 9 hours. Nauman and Rostock corroborated Frankenthal's experimental work and the former also attempted to prevent adhesions by introducing into the peritoneal cavity, sterile pus obtained from abscesses produced by injection of turpentine into the thigh. He reasoned that the tryptic ferment, nucleoprotease, which is liberated from the leucocytes, would act similar to the pepsin, but apparently the introduction of this purulent material had little effect upon the formation of adhesions. If turpentine were injected in the preperitoneal space, however, adhesions did not develop in a fair proportion of cases. Rostock determined experimentally that the pepsin Pregl iodine solution did not cause death of the peritoneal cells for at least 3 hours. Kubota was unable to prevent the reformation of peritoneal adhesions by means of the pepsin Pregl iodine solution.

Kubota, in 1922, reported his results obtained in an extensive investigation in which he employed a large number of substances in an attempt to prevent the reformation of peritoneal adhesions. He attempted, in one series of animals, to prevent the formation of adhesions and in another series to prevent their reformation. He was unable to prevent the formation or reformation of adhesions with a large number of substances which previously had been advocated. Convinced of the unsatisfactory results obtained by the use of all these substances, Kubota used papain as a digestive agent. He found that papain solutions stronger than 1:1,000 produced marked inflammatory reaction of the peritoneum with resultant adhesions, and that solutions more dilute than 1:500,000 were ineffective as regards the prevention of adhesions. Between these two extremes, however, papain solution was effective in preventing the formation and reformation of peritoneal adhesions. Ochsner and Herrmann experimentally were able to prevent the reformation of pericardial adhesions in a large percentage of cases by introducing a papain solution into the pericardial cavity, after the division of the adhesions. Ochsner and Mason, using papain, were able to prevent the reformation of peritoneal adhesions. Anderson and Ochsner attempted to prevent the reformation of experimentally produced subarachnoid spinal adhesions by the use of papain and trypsin solutions. However, because of experimental difficulties encountered, their conclusions were indefinite. Kubota believes that the proteolytic action of papain is activated by lymphocytic and polymorphonuclear leucocytes and blood serum at 37 degrees C. because of the increased number of cells in the peritoneal fluid following the introduction of papain. He maintains, because of results obtained by leucocyte counts of the peritoneal fluid, that the introduction

of a papain solution intraperitoneally causes chemotaxis with a resultant increase in the leucocytes of the peritoneal fluid. Walton (113) from his extensive *in vitro* and *in vivo* investigations on papain activity believes that the effectiveness of papain is due to the direct proteolytic activity of the enzyme and not the result of an indirect action.

The present investigation was undertaken to determine the efficacy of the various digestive ferments in the prevention of peritoneal adhesions. The experimentation has extended over a period of 5 years, as it was felt that a sufficiently large number of observations should be made and a sufficient period of time should elapse between observations, in order better to evaluate the results obtained. In the earlier part of the investigation, papain and papain products were employed as digestive agents. Because of the uniformly good results which were obtained, as regards the prevention of peritoneal adhesions, it was thought advisable to employ the normal proteolytic ferment of the body; i.e., trypsin. It was found, however, that the results obtained by the use of trypsin were much less satisfactory than those obtained with papain. Therefore, in the latter part of the investigation, papain was again used.

Considerable difficulty was encountered in obtaining sterile yet active preparations of the enzymes. It is well known that enzymes are destroyed by heat which obviates one method of sterilization. Enzymes also lose their activity relatively rapidly when in aqueous solution but are relatively stable as a powder. Payr (78) described a "colloidal papain" product sterilized by incubation with Pregl's "iodonascin." Kubota sterilized papain by heating the dry enzyme for one hour at 100 degrees C. It is recognized, however, that this treatment cannot be relied on to effect sterilization in all cases. Sterile preparations were obtained in the earlier experiments either according to the technique of Kubota or by passing the freshly made solution through either a Berkefeld or Seitz filter, following which the solution was used immediately. It was obvious that, if the enzymes were to have any wide clinical application, a sterile dry product must be available so that it may be merely added to sterile saline solution. A method of preparing sterile product of both papain and trypsin was worked out and standardized by Walton (113, 114), to whom we are much indebted for his co-operation, as it is only as a result of his efforts that a great deal of the present investigation was made possible.

Papain[1] is a vegetable digestive ferment obtained from the unripe fruit of the carica papaya or the papaw tree. It is active in neutral and alkaline media. The juice, when dry, forms a powder resembling gum arabic, from which the native product is extracted. The optimal reaction is hydrogen-ion concentration 5.0, although it is less influenced by the reaction than most ferments.

Trypsin is a proteolytic enzyme secreted by the pancreas and is prepared from the pancreatic extract. It is most active in alkaline solutions, the optimal reaction being hydrogen-ion concentration 8.0 to 9.0. Its action is nullified by anti-trypsin which is normally found in exudates, transudates, blood serum, and almost all protein containing body fluids (Waksman and Davison).

It was the plan in the present investigation to determine (1) whether various strengths of the digestive solutions would in any way exert a deleterious effect on the peritoneum, (2) to determine whether they would exert any effect on the formation or the reformation of adhesions. In the original experiments, the effect of papain on the peritoneum of rabbits was determined. Papain solutions of various strengths were introduced intraperitoneally and observations made after 24 and 48 hours. No evidence of irritation was found when solutions more dilute than 1:1,000 were used.[2] In the animals in which solutions stronger than 1:50,000 were used, a dilatation of the large colon occurred without any evidence of peritoneal irritation. Whether this was coincidental or not, it is difficult to say. In solutions weaker than 1:50,000, no such change was observed. Twelve rabbits were used for this purpose, the strengths varying from 1:1,000 to

[1] The papain in the later experiments was kindly supplied us by Parke Davis and Company.

[2] The method of determining peritoneal irritation employed at this time was not as sensitive as that used by Walton and also later by us. Also the fact that the enzyme preparations used at this time were sterilized by filtering through a Berkefeld filter may be partially responsible for the apparent discrepancy between these results and those obtained later by us and also by Walton.

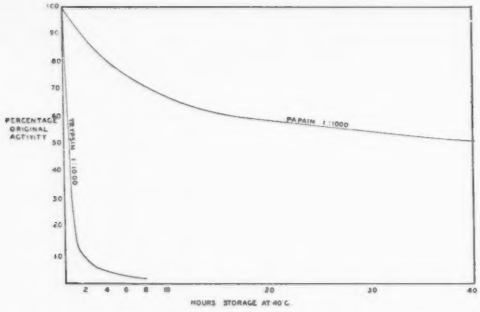

Fig. 1. Diagram illustrating the effect of storage on the digestive activity of papain and trypsin solutions. (After Walton, R. P.)

1:200,000. In the original experiments, sterile solutions were obtained by filtering through a Berkefeld or Seitz filter and, undoubtedly, a considerable amount of activity was decreased by this procedure. In more recent experiments in which a sterile alcoholic precipitate of papain was employed, 4 dogs being used, it was found that solutions more dilute than this caused no change. Dilatation of the colon, similar to that observed in rabbits did not occur in the dogs. Walton (115) found that solutions weaker than 1:15,000 caused no peritoneal irritation. It must be emphasized that the determination of peritoneal irritation by the presence of blood in the peritoneal fluid (used by Walton) represents a very sensitive test. Nine dogs were used to determine the effect of trypsin on normal peritoneum. It was found that solutions stronger than 1:2,000 produced a peritoneal irritation, whereas solutions more dilute than this caused no evidence of inflammatory reaction. Walton (115) determined the *in vitro* stability of papain and trypsin in 1:1,000 dilutions. The activity was determined at intervals up to 40 hours. He found that after 8 hours, the trypsin solution had lost almost all of its activity whereas the papain solution had retained 50 per cent of its activity even after the end of 40 hours (Fig. 1). He also compared the effect on the activity of the addition of serum to papain and trypsin solutions. Solutions of papain (1:1,000) and trypsin (1:30,000) which have approximately similar activity concentrations were mixed with quantities of serum in each case to make a total volume of 100 centimeters. It was found that the addition of serum to the papain solution actually increased the activity whereas the addition of serum to the trypsin solution markedly decreased its activity (Fig. 2). Walton (115) also determined the relative activities of the two enzymes after varying periods of time in the peritoneal cavity. The activity of papain 6 hours after introduction into the peritoneal cavity had decreased to about 48 per cent of its original value, whereas trypsin solutions were completely inactive at the end of 2 hours. This undoubtedly is due to the fact that the action of trypsin is neutralized by anti-trypsin which is normally found in the blood and exudates of the body and because of its instability in solution (Fig. 3).

In the present investigation, 280 animals were used, of which number 252 were dogs and 28 were rabbits. Thirteen dogs and 12 rabbits were used to determine the reaction of the digestive ferments on the peritoneum. In 9 dogs, different solutions of trypsin were used, whereas in 4 dogs and 12 rabbits, various solutions of papain were employed. In the remaining 239 dogs and 16 rabbits, solutions of the enzymes were introduced intraperitoneally following the operation, either after primary trauma of the peritoneum or at a second operation, at which time, peritoneal adhesions were divided. A sterile peritonitis produced by severe mechanical and chemical trauma was employed in most instances. In some, only mechanical trauma was used. In a large number of experiments, the enzymes were used at the time of the original trauma in order to prevent the formation of adhesions; in a still greater number the digestant solution was not used until dense adhesions had formed in order to determine the efficacy of the digestant in preventing the reformation of adhesions after their division, which is comparable to cases seen clinically.

All animals employed were healthy. Each was weighed. Ether was the anæsthetic employed in all series. In some, the intratracheal method of etherization was employed whereas in others, the open drop method was used. The anterior abdominal wall was shaved, cleansed with ether, and painted with U. S. P. tincture of iodine. A right rectus muscle

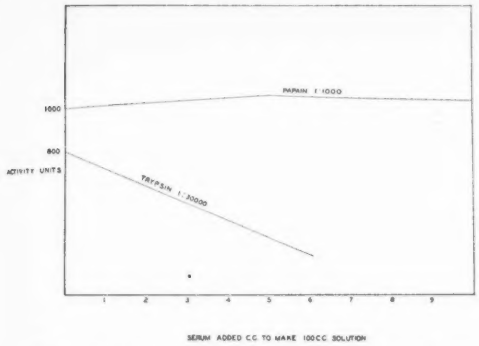

Fig. 2. Diagram showing the effect of papain and trypsin solutions following the addition of serum. In each instance enough serum was added to the digestive solution to make a total quantity of 100 cubic centimeters. (After Walton, R. P.)

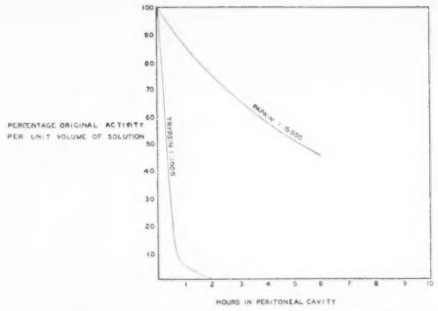

Fig. 3. Diagram showing the effect on the digestive activity of solutions of papain and trypsin after they have been introduced into the peritoneal cavity. (After Walton, R. P.)

splitting incision was made, usually about 3 inches in length. Absolute aseptic precautions were rigidly observed, because it was advisable to obtain an aseptic peritonitis and avoid the variable factor of infection. The ileocæcal region was identified; the cæcum and terminal ileum were drawn through the wound. The ileum was uniformly chosen as the site for traumatization of the gut. The terminal ileum was rubbed vigorously with dry gauze for a distance of about 18 inches proximal to the ileocæcal function. An attempt was always made to confine the trauma chiefly to the antimesenteric border in order to avoid as much as possible subsequent adhesions with the mesentery which would interfere with the blood supply to the gut. After the serosa had been either actually rubbed away or was seriously damaged so that there was marked oozing from the exposed muscularis, in a large group of animals, the gut was again rubbed with gauze saturated with U. S. P. tincture of iodine. In a smaller group of animals, the iodine was not employed because it was found that in those animals in which trypsin was added to the peritoneum, death occurred if iodine were used.

After the trauma, the ileum was returned to the abdomen and the incision was sutured. In nearly all the animals, black silk was the only suture material used. In a considerable number, however, catgut was used for all except the cutaneous suture. The peritoneum and transversalis fascia were closed with a continuous suture. The anterior sheath of the rectus was sutured with a continuous suture as was also the skin. The wound was dressed by means of a thick film of concentrated tincture of benzoin. In the majority of instances, the wound healed well. Of 186 dogs subjected to the combined traumatization and application of iodine, 11 (3.37 per cent) failed to develop adhesions and the trauma had to be repeated. One of the 11 dogs failed to develop adhesions even after the repeated trauma and the procedure had to be performed a third time before adhesions were produced. Another of the 11 dogs died after the repetition of the trauma and no adhesions were found at autopsy. The 9 remaining dogs developed dense adhesions following the re-traumatization.

The adhesions which developed usually caused a partial intestinal obstruction with attendant inanition and lowered vitality. The animal hence became an easy victim to pneumonia or to intestinal parasites. Those animals which survived were reoperated upon. The interval between the original operation and the reoperation varied. It was usually about 2½ weeks. However, in many it was considerably longer than this. Care was taken to see that the dog was at least fairly active and had a good chance to live for at least several days or weeks. The operation was not done until the wound of the primary operation was well healed. This precaution was observed in order to prevent an infection from

TABLE I.—DOGS WHICH HAD TRAUMA AND IODINE AT FIRST OPERATION, LATER RE-OPERATED UPON, ADHESIONS DIVIDED, NOTHING ADDED

	Number of animals	Percentage
No adhesions	0	0
Total few or no adhesions		0
Adhesions++++	11	100
Total dense adhesions		100

TABLE II.—DOGS WHICH HAD TRAUMA ALONE AND NORMAL SALINE SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	2	15.38
Adhesions+	2	15.38
Adhesions++	3	23.07
Total few or no adhesions		53.83
Adhesions+++	1	7.69
Adhesions++++	5	38.46
Total definite or dense adhesions		46.15

the previous wound being a source of peritonitis following the operation. The second operation was performed similar to the first. Adhesions which were found were divided either by blunt or sharp dissection. Hæmostasis was secured at once by ligature or suture. In those animals in which no adhesions were found, the gut was re-traumatized as in the original operation. In some few instances, the adhesions were so excessive that resection of the involved gut was necessary. The adhesions were classified as follows: (1) no adhesions, indicating no evidence of peritoneal bands; (2) adhesions +, one or a few adhesions, veil-like in nature and involving only a small portion of the omentum or gut; (3) adhesions ++, several fibrous bands involving a few loops of gut; (4) adhesions +++, adhesions fairly extensive involving the omentum and numerous loops of gut and fairly difficult to separate; (5) adhesions ++++, very dense adhesions, matting the gut into a nearly solid mass over which the omentum is adherent (unless adhesions were sufficiently dense to be considered as three plus or four plus, the gut was re-traumatized in order to cause the formation of more extensive adhesions). After division of all adhesions, the gut was then returned to the abdominal cavity, the peritoneum and transversalis fascia were carefully sutured so as to form as nearly a water-tight suture line as possible. Just before tying the last suture, the tip of a small glass funnel was introduced through the angle of the incision and the solution used was introduced through the funnel directly into the peritoneal cavity. As a rule, as much solution was poured in as was readily possible with the animal well anæsthetized. In the majority of instances, this varied from 500 to 1,000 cubic centimeters in the dogs. Subsequent observations were made at reoperation after periods of time, varying from a few days to several months. Immediate autopsy was performed on all dogs which died and those which were sacrificed.

By following the procedure outlined, the clinical picture of adhesions was reproduced as nearly as possible. Dogs were not subjected to observations regarding the possible recurrence of adhesions until it could be demonstrated that adhesions had formed as a result of previous trauma. In the light of past experience, it would be logical to expect these adhesions to reform. As would be expected, a large number of dogs died soon after the operation before any observations regarding the reformation of adhesions could be made. Eighty-nine dogs must be considered as belonging to this group. All of these dogs were subjected to gauze and iodine trauma, as outlined above. Eighty-three died following the primary operation. Six were reoperated upon, but as there were no adhesions present, a second operation was done with re-traumatization of the gut, following which they died. Of the 89, 32 died of intestinal obstruction (24 partial and 8 complete); 24 died of pneumonia; 11 died of inanition; 3 were killed by other dogs; 3 died as a result of the operation. Acute peritonitis, acute stomatitis, filaria, wound infection, empyema and a mediastinal abscess were each responsible for death in one animal and in 8, the cause of death was undetermined.

Four groups of control animals were used. Group I—11 dogs had trauma and iodine at the original operation and were later reoperated upon, at which time the adhesions were divided. Nothing was added to the peritoneal

cavity. Subsequent observation showed that dense adhesions were present in all, 100 per cent (Table I). Group II—13 dogs had trauma alone at the original operation, following which normal saline was introduced into the peritoneal cavity. Of these 15.38 per cent developed no adhesions whereas in 84.60 per cent adhesions occurred. In 38.45 per cent, however, the adhesions were classified as + and ++, leaving 46.15 per cent which developed dense adhesions and 53.83 per cent which developed few or no adhesions (Table II). Group III—6 animals had trauma and iodine at the original operation, following which normal saline was introduced intraperitoneally. Adhesions formed in each instance. In 50 per cent of the animals, the adhesions were classified as +, and in the remainder definite or dense adhesions were formed (Table III). Group IV—trauma and iodine were employed at the original operation and at a subsequent operation, the adhesions were divided and normal saline introduced into the peritoneal cavity. No adhesions developed in 6.66 per cent whereas in 93.32 per cent adhesions recurred. In 86.66 per cent, the adhesions were classified as definite or dense adhesions (+++ and ++++) (Table IV). Fifteen animals were used. The comparative results obtained in the control series are shown in Figure 4. It is seen that the incidence of adhesions is much greater following division of already formed adhesions than that following primary trauma. Saline solution apparently is of some slight value in the prevention of reformation of adhesions as evidenced by a comparison of the results obtained in control groups I and II. Of the animals which received saline solution intraperitoneally after the division of the fibrous adhesions, 13.32 per cent developed few or no adhesions and 86.66 per cent developed definite or dense adhesions whereas adhesions recurred in 100 per cent of those animals which did not receive an intraperitoneal injection of saline solution after division of the adhesions.

The effect of papain on the prevention of peritoneal adhesions was observed in 60 animals—44 dogs and 16 rabbits. In the 44 dogs in which papain was used, adhesions were produced by trauma and iodine at the original operation. At a subsequent laparotomy, the adhesions were divided and before complete closure of the abdomen, a solution of papain was introduced into the peritoneal cavity. Observations made subsequently determined the presence or absence of adhesions and the degree of the same (Table V). No adhesions reformed in 65.9 per cent, whereas adhesions recurred in 34.07 per cent. The adhesions were classified as + and ++ in 20.45 per cent and 4.54 per cent respectively and in only 9.08 per cent were the adhesions definite and dense (Figs. 5, 6, and 7). In the control group which were operated on under similar conditions, 13.32 per cent developed few or no adhesions whereas 86.66 per cent developed dense or definite adhesions (Fig. 8). In 16 rabbits in which papain solution was used, the procedure varied somewhat from that used in the dogs in that the papain was added to the peritoneal cavity at the original operation after trauma and iodine had been used. As might be expected, the incidence of occurrence of adhesions in this experiment was less than that in which papain was used to prevent the reformation of adhesions. Ninety-three and seventy-five hundredths per cent developed few or no adhesions whereas only 6.25 per cent developed definite or dense adhesions (Table VI and Figs. 9 and 10).

The effect of trypsin solution on the development of peritoneal adhesions was observed in 37 dogs. In 11, the trypsin was added at the time of the original operation at which time mechanical trauma of the peritoneum alone was used, without the addition of iodine. In 45.45 per cent, no adhesions developed whereas in 54.54 per cent adhesions formed. In only 9.09 per cent were the adhesions of such character as to be classified as +++ or ++++ (Table VII). In 26 dogs, the trypsin solution was introduced into the peritoneal cavity at a second operation after the division of already existing adhesions in an attempt to prevent their reformation. In 15.38 per cent, no adhesions reformed whereas in 84.54 per cent, adhesions recurred. In 26.9 per cent, however, the adhesions were classified as +, leaving 57.63 per cent in which definite or dense adhesions reformed

(Table VIII). Trypsin solutions were more efficacious than saline solutions in preventing the reformation of adhesions as 86.66 per cent of the animals receiving saline solution developed definite adhesions in contrast to 57.63 per cent receiving trypsin solution (Fig. 8). Trypsin, however, was much less efficient as regards the prevention of the reformation of peritoneal adhesions than was papain, as only 9.8 per cent of the animals which received papain solution following the division of the adhesions developed new, definite, and dense adhesions (Fig. 8).

In the earlier experiments, before a satisfactory preparation of the ferment was devised, the activity and sterility of each "batch" of digestant was determined. In those instances in which it was demonstrated by *in vitro* experiments that the enzyme was inactive, and in those cases in which by culture the preparation was found to be contaminated, the animals were not used. Inactive and contaminated papain preparations were responsible for discarding 7 and 5 animals, respectively. All of these occurred in the earlier experiments before the presently employed method of preparation was used. In 6 cases, excessive digestion of the peritoneum occurred as the result of the use of solutions stronger than 1:1,000. In no instance was there evidence of excessive digestion of absorbable sutures.

DEDUCTIONS

The excessive fibrinous adhesions which form following severe peritoneal trauma, after their function has been served usually disappear, as a result of tryptic digestion, the digestive enzyme being derived from the destroyed polymorphonuclear leucocytes. Possibly in those individuals with an "adhesions diathesis" or "keloid tendency," an insufficient amount of digestive ferment is liberated to remove the excessive amounts of fibrin which subsequently becomes organized. If this hypothesis is correct, it is logical that the addition of a similar ferment to the peritoneal cavity would be of value in preventing the reformation of adhesions as the normal process of digestion of fibrin would be minimized. An attempt was made in the present investigation to determine the relative efficiencies of two digestive ferments; i.e., trypsin and papain, in the prevention of peritoneal adhesions. Both substances are similar in that they are enzymes, trypsin being an animal enzyme whereas papain is a vegetable ferment. From a theoretical consideration, it is logical to assume that trypsin might be more efficient than papain in that it occurs normally in the body. However, our results do not support this assumption. In 26 animals in which, following the division of reformed adhesions, trypsin solution was introduced intraperitoneally, adhesions reformed in 84.53 per cent. However, in 26.9 per cent, the adhesions were slight and lessened in density. Therefore, in only 57.63 per cent were the adhesions not reduced in severity. In 15.38 per cent of the observations, the adhesions were entirely prevented from reforming. These results are in distinct contrast to those obtained in a control group of animals in which, following the division of adhesions, saline solution was used: in only 6.66 per cent were the adhesions entirely prevented from reforming whereas in 86.66 per cent, definite or dense adhesions recurred. In a similar group of 44 animals, papain was used. No adhesions reformed in 65.9 per cent whereas in 34.07 per cent, adhesions recurred. In 24.99 per cent, however, there were relatively few adhesions which were not dense in character, leaving only 9.08 per cent with definite and dense adhesions which reformed following the use of papain. This is in distinct contrast to the results obtained in the control group in which saline solution was used. These results are distinctly better than those obtained by Trussler with amniotic extract. Trussler reports in a series of 22 dogs, one of which died of "peritonitis or obstruction," that no adhesions were formed in 5 (23.8 per cent) as compared with 65.9 per cent obtained with papain by us. Adhesions reformed in 70.6 per cent of Trussler's cases in which amniotic extract was used whereas adhesions reformed in 34.07 per cent of our cases in which papain was used. In 28.56 per cent of Trussler's cases with amniotic extract, the adhesions were moderate or dense whereas in only 9.08 per cent of our cases were the adhesions moderate or dense. The greater efficacy of papain becomes even more marked

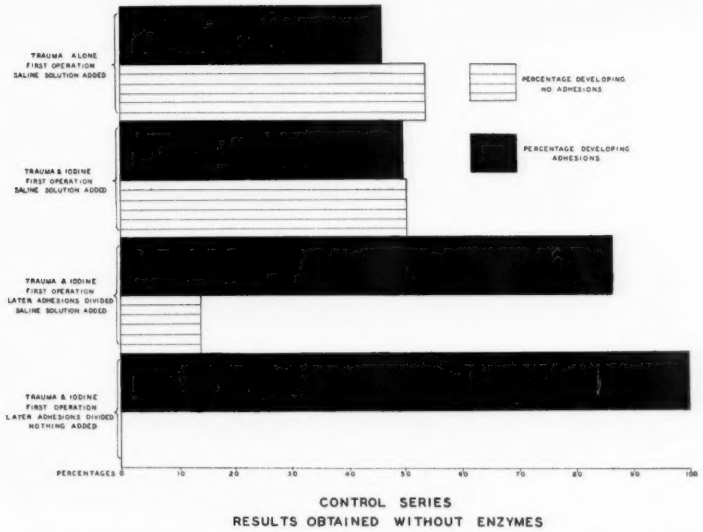

Fig. 4. Control series. Diagram illustrating the incidence of adhesion formation or reformation following trauma or division of adhesions. In each instance either nothing was added to the peritoneal cavity or saline solution was added.

when it is realized that Trussler's observations were made on the formation of peritoneal adhesions after trauma alone whereas ours quoted above concerned the reformation of dense adhesions after their division. The results we obtained with trypsin in the prevention of the formation of adhesions after trauma alone as compared with those of Trussler's, are as follows: no adhesions—trypsin, 45.45 per cent; amniotic extract, 23.8 per cent; formation of adhesions—trypsin, 54.54 per cent; amniotic extract, 70.6 per cent; moderate or dense adhesions—trypsin, 9.09 per cent; amniotic extract, 28.56 per cent. It may seem rather odd that better results would be obtained by the use of papain than by the use of trypsin. The poorer and inconstant results obtained by the latter ferment are undoubtedly due to the fact that trypsin solutions when placed in the peritoneal cavity rapidly lose their activity (within 2 hours they are completely inactive). The rapid loss in activity possibly is due to "neutralization" by antitrypsin which the plasma, transudates, exudates, and most body fluids normally contain. Papain, on the other hand, retains its activity in the peritoneal cavity even after long periods of time and its activity is not decreased by the

TABLE III.—DOGS WHICH HAD TRAUMA AND IODINE AND NORMAL SALINE SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	0	0
Adhesions+	3	50
Adhesions++	0	0
Total few or no adhesions		50
Adhesions+++	2	33.3
Adhesions++++	1	16.6
Total definite or dense adhesions.		49.9

TABLE IV.—DOGS WHICH HAD TRAUMA AND IODINE AT FIRST OPERATION, LATER REOPERATED UPON, ADHESIONS DIVIDED, NORMAL SALINE SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	1	6.66
Adhesions+	0	0.0
Adhesions++	1	6.66
Total few or no adhesions		13.32
Adhesions+++	3	20
Adhesions++++	10	66.66
Total definite or dense adhesions.		86.66

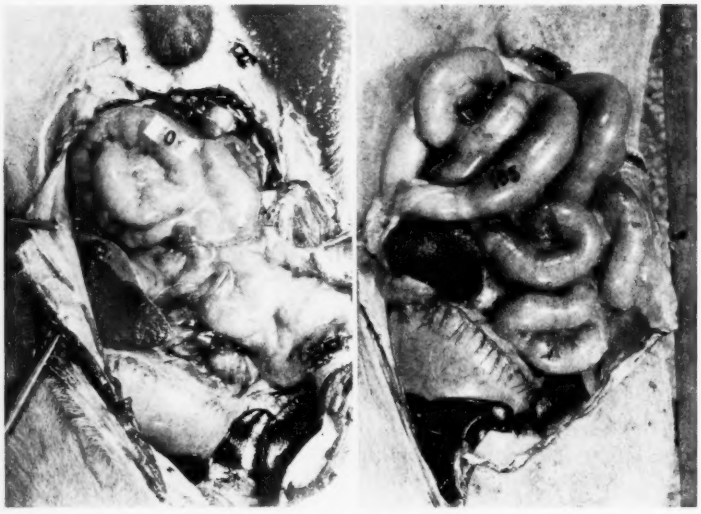

Fig. 5. A, left, Photograph of control Dog 106 sacrificed 4 weeks after division of adhesions. Nothing added to peritoneal cavity. The intestinal loops are matted together by dense adhesions, there being no free peritoneal space. B, Photograph of Dog 105 sacrificed 4 weeks after division of peritoneal adhesions, at which time abdomen was filled with a 1:100,000 papain solution. A complete absence of peritoneal adhesions is evident in contrast to the control animal.

addition of serum. The possible digestion of excessive amounts of fibrin when papain is introduced into the peritoneal cavity is thus apparent.

We have demonstrated repeatedly that both papain and trypsin will not prevent the formation of adhesions in the presence of infection. This is probably due to the fact that bacterial trauma in contrast to mechanical trauma is continued. Mechanical trauma is finished by the time the abdominal wound is closed and there is no continued stimulus for the development of fibrinous adhesions. Neither of the digestive ferments would be influential in preventing adhesions in the presence of infection. It is, of course, appreciated that it is not desirable to prevent adhesions when infection is present. On the contrary, the chance of recovery is almost directly proportional to the ability of the peritoneum to combat the infection by forming adhesions. The prime defense reaction of the peritoneum is the formation of adhesions. When bacterial trauma has been inflicted upon the peritoneum, it should not be robbed of its chief means of protection. Digestive enzymes do not interfere with adhesion formation in the presence of infection. Their use is not indicated in peritonitis, but experimentally, at least, they cause no harm even though infection is present. Digestive enzymes are especially indicated in those cases in which the reformation of already existing adhesions is not only desirable but also imperative.

Numerous buffer solutions were used, but it was found that very satisfactory active preparations could be obtained by using normal saline solution as a solvent for the papain prepared according to Walton's (114) technique. Numerous experiments were made to determine the optimum strengths and hydrogen-ion concentrations and the best solvents. It was found that even though the optimum reaction for papain is hydrogen-ion concentration 5, it is very active at a hydrogen-ion concentration of 7. Solutions of papain more concentrated than 1:1,000 frequently cause excessive digestion. Kubota reported effective activity in papain solutions as dilute as 1:500,000. We have been able to

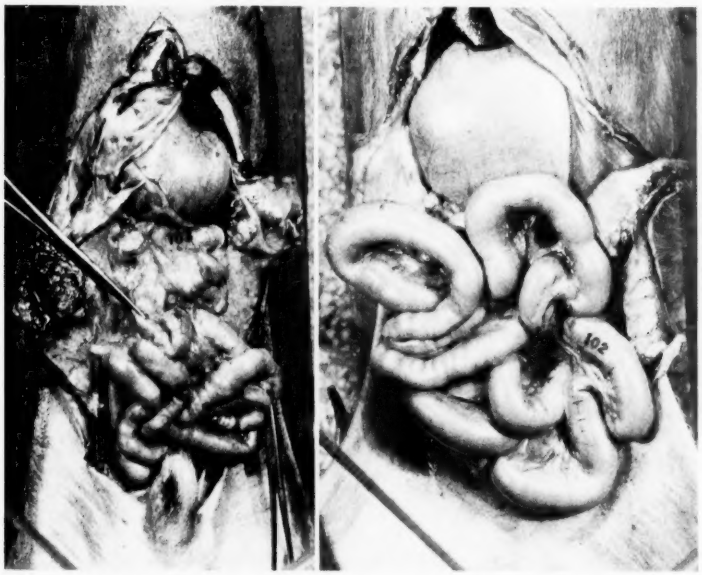

Fig. 6. A, left, Photograph of control Dog 103 sacrificed 6 weeks after division of adhesions. Saline solution added to peritoneal cavity. Numerous loops of intestine are matted together by dense adhesions. B, Photograph of Dog 102 sacrificed 6 weeks after division of adhesions. Papain solution (1:100,000) was introduced intraperitoneally at the time of division of adhesions. There is complete absence of adhesions in contrast to those in the control animal.

obtain satisfactory results with a solution of 1:400,000. In our investigations, the solutions found to be most satisfactory were between 1:50,000 and 1:100,000, there apparently being little difference in the results obtained by the use of these various strengths. Walton (115) found that the minimal fatal concentration for papain was 1:2,000, whereas we found that the minimal effective concentration was 1:400,000. This represents a "therapeutic index" of 200 which is many times higher than that of most drugs used routinely. This hardly supports Warren's contention that "papain is hardly suitable for use in human beings because of the narrow zone between effectiveness and irritation." The fact that the concentrations of enzymes within the gastro-intestinal tract are many times higher than those employed by us demonstrates that the living cell is not attacked by the enzymes.

Even though the present discussion is concerned with the prevention of the reformation

TABLE V.—DOGS WHICH HAD TRAUMA AND IODINE AT FIRST OPERATION, LATER RE-OPERATED UPON, ADHESIONS DIVIDED, PAPAIN SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	29	65.9
Adhesions +	9	20.45
Adhesions + +	2	4.54
Total few or no adhesions		90.89
Adhesions + + +	1	2.27
Adhesions + + + +	3	6.81
Total definite and dense adhesions		9.08

TABLE VI.—RABBITS WHICH HAD TRAUMA AND IODINE AND PAPAIN SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	10	62.5
Adhesions +	3	18.75
Adhesions + +	2	12.5
Total few or no adhesions		93.75
Adhesions + + +	0	0
Adhesions + + + +	1	6.25
Total definite or dense adhesions.		6.25

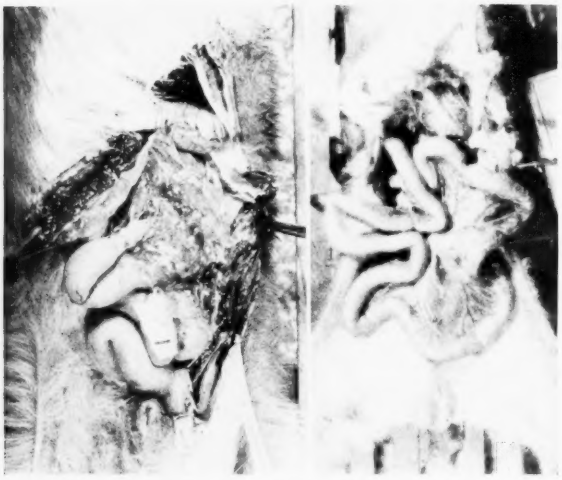

Fig. 7. A, left, Photograph of control Dog 100 sacrificed 2 weeks after division of adhesions. Saline solution was added to the peritoneal cavity. There is a reformation of dense adhesions, especially involving many loops of bowel and the omentum. B, Photograph of Dog 101 taken 2 weeks after division of adhesions. Papain solution (1:100,000) introduced into the peritoneal cavity. There is a complete absence of adhesions.

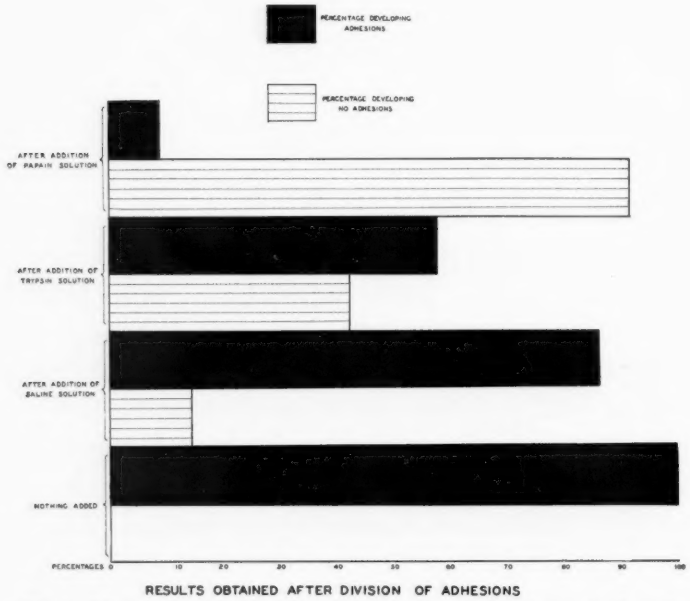
PERCENTAGE DEVELOPING ADHESIONS
PERCENTAGE DEVELOPING NO ADHESIONS
AFTER ADDITION OF PAPAIN SOLUTION
AFTER ADDITION OF TRYPSIN SOLUTION
AFTER ADDITION OF SALINE SOLUTION
NOTHING ADDED
PERCENTAGES 0 10 20 30 40 50 60 70 80 90 100
RESULTS OBTAINED AFTER DIVISION OF ADHESIONS

Fig. 8. Diagram showing the relative efficacy of digestive solutions and saline solution in preventing the reformation of adhesions after division of dense adhesions.

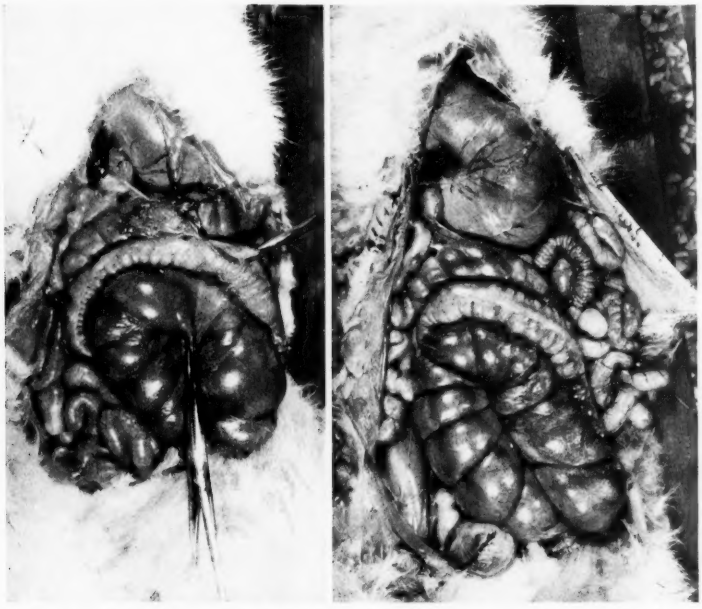

Fig. 9. A, left, Photograph of control rabbit sacrificed 10 days after mechanical and chemical trauma to peritoneum. Dense adhesions are formed between the loops of traumatized bowel. B, Photograph of rabbit sacrificed 10 days after mechanical and chemical trauma. Papain solution, 1:400,000, introduced intraperitoneally. There is no evidence of peritoneal adhesions.

of peritoneal adhesions in those individuals in whom there is a special tendency toward the development of adhesions, it must be emphasized that a great deal can be accomplished prophylactically in the prevention of adhesions. As previously mentioned and as appreciated by all surgeons, but unfortunately not appreciated by mere operators, extreme gentleness in all intraperitoneal operations is paramount. Every insult to the peritoneum must be avoided. Strict asepsis, avoidance of mechanical and chemical trauma, and the use of a minimal number of foreign bodies (tampons, drains, etc.), as well as the prevention of chilling and dehydration of the peritoneum during laparotomies, must be rigidly adhered to if the primary formation of adhesions is to be decreased. However, cases will be encountered in which in spite of all these precautions adhesions will continue to

TABLE VII.—DOGS WHICH HAD TRAUMA ALONE AND TRYPSIN SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	5	45.45
Adhesions +	4	36.36
Adhesions + +	1	9.09
Total few or no adhesions		90.90
Adhesions + + +	1	9.09
Adhesions + + + +	0	0.0
Total definite and dense adhesions		9.09

TABLE VIII.—DOGS WHICH HAD TRAUMA AND IODINE AT FIRST OPERATION, LATER REOPERATED UPON, ADHESIONS DIVIDED, TRYPSIN SOLUTION INTRODUCED INTRAPERITONEALLY

	Number of animals	Percentage
No adhesions	4	15.38
Adhesions +	7	26.9
Adhesions + +	0	0.0
Total few or no adhesions		42.28
Adhesions + + +	5	19.23
Adhesions + + + +	10	38.4
Total definite or dense adhesions.		57.63

Fig. 10. A, left, Photograph of control rabbit sacrificed 3 days after mechanical and chemical trauma. Adhesions with fibrinous plastic exudate are visible on several loops of bowel. B, Photograph of rabbit sacrificed 10 days after mechanical and chemical trauma. Papain solution (1:200,000) was introduced intraperitoneally after peritoneal trauma. In contrast to the control animal (Fig. 10A) there is no evidence of adhesion formation.

develop. It is in this type of individual that it is hoped that the digestive ferment will prove of clinical value.

CONCLUSIONS

Peritoneal adhesions are protective in the presence of infection. Normally, the diffuse fibrinous adhesions which form in the peritoneal cavity following mechanical, chemical, or bacterial trauma disappear after their usefulness has been served, the fibrin being digested by a proteolytic ferment liberated from polymorphonuclear leucocytes. If the fibrin is not removed, it becomes organized; i.e., replaced by fibrous tissue. Following division of the fibrous adhesions, they may recur. Individuals with an inherent tendency toward the development of fibrous tissue; i.e., "adhesions diathesis" or "keloid tendency" are especially apt to reform adhesions after their division.

Numerous substances and methods have been used to prevent the formation and reformation of adhesions, but few have proved to be of any value.

In the present investigation, the efficacy of digestive ferments in the prevention of the formation and reformation of peritoneal adhesions was determined.

Following division of pre-existing adhesions, adhesions reformed in 100 per cent. If, however, saline solution was added to the peritoneal cavity following division of the adhesions, few or no adhesions reformed in 13.32 per cent. If trypsin and papain solutions were

added, few or no adhesions formed in 42.28 per cent and 90.89 per cent, respectively. It is evident that experimentally, at least, digestive ferments (especially papain) are of value in preventing the reformation of peritoneal adhesions.

Trypsin and papain solutions have been used in 14 clinical cases. The period of observation is still too short for one to draw any conclusions concerning the end-results in these cases. In one case, however, operated upon several times for adhesion ileus, in which trypsin was employed, there has been a recurrence of adhesions. The others have remained free from symptoms for from 6 months to 5 years. From both our experimental and clinical observations, we are convinced that the intraperitoneal injection of papain solution in the dilutions recommended is entirely without danger.

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ECONOMIC READJUSTMENT FOLLOWING HEAD INJURIES[1]

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IN dealing with the economic and industrial aspects of head injuries, it is necessary to dispel at once the conception of certain mysterious and ill-defined consequences resulting from injuries to the brain during the acute period of clinical study, and to recognize the occurrence of certain definite common sequelæ which may be attributed to organic changes not detectable by ordinary neurologic examinations.

During the past few years, it has become clear that the early administration of prompt and efficient treatment in cases of severe injury to the brain not only assures the patient of a better chance of survival but determines to a large degree the resultant mental disability. Too frequently the clinician's attention is directed only toward the preservation of life by palliative means with the result that the patient is passed along to the neurologist or neurologic surgeon as a chronic case of mental deterioration and an almost certain total economic loss.

The close correlation between the acute stage of the problem and the subsequent posttraumatic mental sequelæ has been a matter of careful investigation during the past 9 years. We have recognized that not only must the patient be protected from his immediate danger of death, due to involvement of the "vital" centers by pressure, but also that the entire function of the brain, dealing with intelligence, memory, and judgment, requires active consideration during the early hours following a severe cerebral injury.

For our purposes, the brain may be divided into two areas dealing primarily with separate functions: first, those nuclei concerned with maintaining life, such as the vasomotor, cardiac, and respiratory centers which we term vital centers; and, second, those portions of gray matter which have to do with intelligence, appreciation, and expression of the individual in relationship to his environment, situated in the cortex of the cerebrum and cerebellum, which we may term the gnostic regions. From the immediate clinical standpoint, the vital centers are most important, but from the economic and industrial standpoint the gnostic areas of the brain are necessary to permit the re-establishment of the individual to his social state.

The vital centers are situated at the base of the brain (Fig. 1), in the region of the third ventricle, the pons and medulla, and definitely indicate the zone of danger toward which the clinician should direct every measure of protection. The cerebral hemispheres and cerebellum are masses of functioning and reacting tissues, which are unnecessary for the actual continuation of life but are of the highest importance in the intelligent reactions and conscious expression of the individual. Injury or destruction of the former is followed by death within 3 to 6 hours, and all of the present clinical methods at our disposal fail to help the patient. Destruction or injury to the latter, however, is characterized by a loss of function and transient or continued paralysis. The clinician must keep clearly in mind that the neurologic examination reveals the signs of loss of function of the higher centers, whether it be inhibitory in nature, controlling reflex and psychic manifestations, or an apparent paralysis or anæsthesia. The loss of consciousness becomes as important as an actual paralysis in the early phases of the problem. Furthermore, there is a great danger that the factors leading to local cortical compression which are responsible for the loss of the conscious elements may spread in the form of œdema to the vital basal centers, and the patient perish from this complication.

Unlike any other organ, the brain is contained within a space of fixed volume (the skull, after closure of the sutures), and the function of this organ must be maintained within these volume relationships. In the presence of adequate oxygen and circulation, brain tissue will survive and tend to function, but with the advent of œdema or gross hæmatomata, the blood supply becomes insufficient

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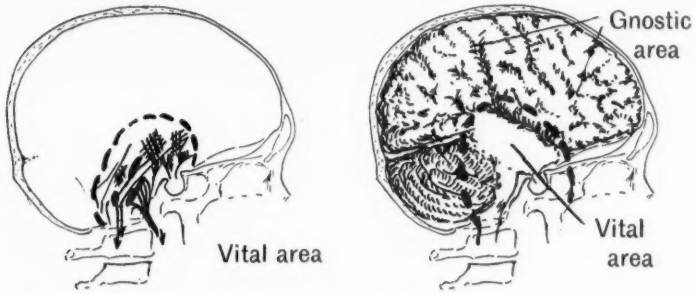

Fig. 1. Division of the brain into (a) vital and (b) gnostic areas. The vital areas are concerned during the immediate post-traumatic phase. The gnostic areas not essential to life, but of great importance to economic readjustment. Injuries to the former, fatal; to the latter, leave evidence of mental and physical disability.

to supply adequate oxygen, and in this circumstance the "gnostic" areas suffer primarily and most severely, not only because they are at the moment least important, but because they receive five times the blood supply of the basal cells and are exposed to surface compression, and are consequently more sensitive to proportionate diminution in circulating blood volume (oxygen).

As the skull determines the limitation of intracranial volume, and as there can be no increase in volume by any of the components contained therein without an equal withdrawal of one of the factors, the problem of treatment of intracranial injuries resolves itself into attempts to maintain optimal circulation by subtracting from the cranial contents a certain volume of the least important components.

Thus, if we consider a fixed volume container, such as the skull, filled by three distinct volume components (Fig. 2)—(a) arterial and venous blood, (b) nervous cellular tissue and meninges, and (c) fluid—cerebrospinal, interstitial, and intracellular—it is evident that if we increase the fluid volume component in the form of œdema, there must be a similar decrease in blood volume, and vice versa, because the two fluid components are incompressible, and the fixed container unyielding. When it is not possible to establish compensation between the two fluid components over a period of time there arises the yielding of the third volume mass, i.e., the nervous tissue (atrophy), so that eventually although the normal ratio of the three components has definitely shifted, the total volume relationships remain the same.

In terms of clinical experience, this means, for instance, that a subdural hæmorrhage introduces a new tumor mass, and, if it occurs rapidly, displaces first the excessive venous blood, as the mass volume increases. When this compensatory factor has been completely expressed to its physiological limit, cerebrospinal fluid is likewise eliminated, as the mass volume of the hæmatoma increases, pressing the brain before it and finding no resistance. Spinal pressure is not elevated because there has been an equal subtraction for the volume of the tumor introduced. Cerebral function has not been interrupted because the relationships favorable to ample circulation still maintain, so long as volume displacements are adequate. This is well recognized in the clinical picture of a sudden blow, with transient unconsciousness followed by a lucid interval and later a return to the unconscious state. The return of the unconscious state indicates a deficiency in cerebral circulation because the limits of compensation have been passed, and consequently the fresh arterial blood volume begins to be diminished in the finer capillaries of the cortex in the presence of the expanding tumor mass. With the reduction in capillary circulation, there is a suspension of cortical function and the resultant anoxæmia now gives rise to a rapid tissue œdema.

The same clinical analogy may be given for tumors of the brain, although they are slower

in growth. The final compression symptoms are identical, and the volume relationships similarly disturbed, so that unconsciousness finally occurs if relief is not at hand. In the same way, cerebrospinal fluid volume increases in the form of excessive spinal fluid, or actual intracellular œdema, thus disturbing the circulatory ratio and giving rise to the more abrupt clinical picture of stupor. When both vascular engorgement and cerebral œdema occur simultaneously, intracranial pressure rises and we recognize the profound stupor and serious involvement of both the vital and gnostic areas. This is the most frequent type of reaction in cerebral injuries, especially when a blow has been sufficiently severe to produce a fracture of the skull with concussion and contusion of the brain. In the early stages of cerebral trauma and compression, the cortical capillary bed yields first to this process, giving a state of stupor or unconsciousness which persists until adequate circulation is restored.

The vital centers at the base of the brain are well protected by solid masses of white matter, and receive their blood supply directly from the basilar artery and the circle of Willis, and their capillary network is not exposed to the surface compression which occurs over the cortex during periods of generalized pressure. However, as the process of œdema begins in the cortical layers of the brain, a swelling in the brain volume occurs, with rapid continuation of the œdema into the basilar areas. Thus the terminal picture is usually one of vasomotor failure associated with respiratory irregularity, and as oxygen becomes less available to the brain, due to a failing circulatory pressure and paralysis of the vasomotor mechanism, the respiratory center fails, and leaves the intrinsic mechanism of the heart to beat on for a few moments after all other neurologic activity has ceased.

If we are to accomplish not only a protection of the vital centers but an early reestablishment of cortical circulation to protect the gnostic areas, the treatment must be vigorously directed toward complete control of the cerebral volume relationships, and the patient must not be permitted to remain in an unconscious state if it is possible to prevent it. This means that the clinician must continue the method of treatment, not only to the satisfaction of the vital centers, but must aim toward sufficient return of circulation to permit cortical function as soon as possible following the injury.

Fortunately, the methods now at hand have not only yielded a marked reduction in mortality, but have been attended by a prompt return to consciousness (1, a, b). Of greatest importance has been the rapid economic readjustment, where formerly convalescence was slow and the economic readjustment delayed or entirely impossible.

The method of treatment may be summarized in the statement that every means of subtracting fluid volume from the cranial cavity has been employed from the earliest possible moment. Fifty cubic centimeters of 50 per cent glucose is immediately given to the patient intravenously. This aids in the subtraction of cerebrospinal fluid and the intracellular fluid of the brain, prevents temporarily further œdema, and counteracts shock by increasing blood volume with resultant improvement in blood pressure. Complete spinal drainage follows to allow further space for the necessary blood volume, and is repeated in 4 to 6 hours if necessary. This entails the withdrawal of from 45 to 100 cubic centimeters of clear or bloody spinal fluid, as the case may be. Magnesium sulphate or other hydragogues are given by mouth or rectum to withdraw fluid from the blood stream through the intestinal tract, as soon as the "shock" period is over. Fluid intake of the patient is restricted to from 20 to 30 total ounces of liquid per day for the first 10 days, and the patient is maintained after discharge from the hospital on a fluid level of 32 ounces for a period of 3 months. Thus the factors of œdema and fluid volume are restricted to permit the optimal volume of blood circulation, oxygen content, and the preservation of cerebral tissue and function in the absence of compression. The cases which have not yielded to this method of treatment have been few and have offered insurmountable problems, such as intramedullary hæmorrhage in the neighborhood of the vital centers, especially the pons, or cerebral contusions so extensive that the intracellular œdema of the brain could not

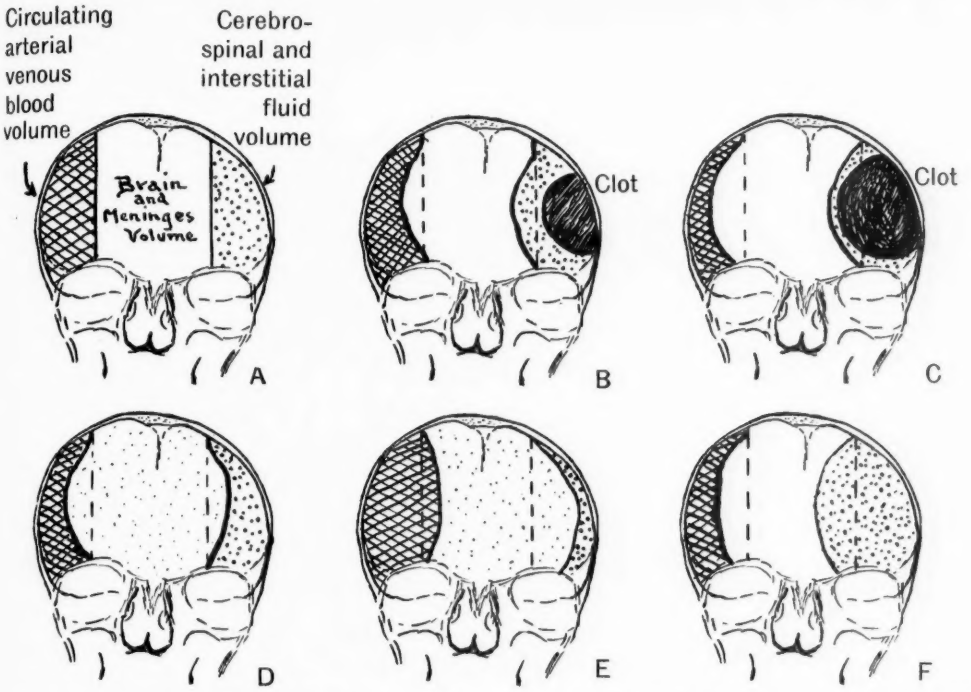

Fig. 2. Diagrammatic representation of volume relationships within the skull with varying displacements of component volumes in certain types of cerebral trauma. The clinical symptoms are based upon compensation or decompensation between the component volume relationships. The importance of reducing the cerebrospinal fluid component is evident, in order to preserve the vascular and brain volumes, which determine function and the survival of the brain tissue.

A, normal; *B*, compensated volume displacement; *C*, decompensation with compression anæmia; *D*, cerebral œdema with compression anæmia; *E*, cerebral hyperæmia with œdema, increased intracranial pressure; *F*, cerebral atrophy, chronic increased intracranial pressure.

be controlled by any method now at our disposal.

Surgical decompression has been afforded these cases only as a measure of last resort, but has failed in every case to benefit the patient. In other words, decompression has not succeeded where dehydration failed, and the mortality from decompression in this series is one hundred per cent. Early decompression is an unjustified procedure in cases of cerebral trauma, in my opinion. The surgeon only adds insult to injury, and does not accomplish as thoroughly as by dehydration the object for which the decompression was designed. Cerebral hernia, massive hæmorrhage, and further lacerations of the brain are almost constantly produced where surgical decompressions are undertaken in the presence of increased intracranial pressure. In the past the surgeon has escaped the criticism he merits because of the unquestioned acceptance by the profession and the laity of the statement that the patient died "of a fracture of the skull." However, our experience clearly indicates that early decompression accomplishes nothing that dehydration cannot better effect, and only greatly endangers the patient's critical condition by further cerebral trauma. The decompression here alluded to is the commonly accepted pernicious subtemporal decompression, or decompression over the site of the fracture. It is not to be confused with the orderly and intelligent exploration of the brain if the signs of an epidural or subdural hæma-

toma indicate the necessity of removing a clot. Here the exploration is not only indicated but imperative if the signs of focal pressure have established the presence of a subdural or epidural hæmorrhage. The differential diagnosis is based upon several factors. A middle meningeal hæmorrhage usually gives the clinical picture of a lucid interval, with subsequent loss of consciousness, with cortical irritative signs, or focal signs developing rapidly in the presence of clear spinal fluid. Bloody spinal fluid should necessitate prolonged and careful observations as the bleeding responsible for this bloody spinal fluid has its origin from a rupture of a cortical or pial vessel, and is not related to a subdural hæmatoma. When a subdural hæmorrhage occurs in conjunction with subarachnoid bleeding, the treatment indicated requires attention to the subarachnoid bleeding and intracranial pressure as a first consideration. The exploration for a coincidental middle meningeal hæmorrhage may be delayed for hours or days, and it has been our policy to await the seventh to tenth day when the patient's condition is satisfactory, rather than enter the field of a middle meningeal hæmorrhage in the presence of severe cerebral pressure and œdema.

Too frequently we have had the experience of successfully removing a subdural hæmatoma, only to encounter a rapidly expanding brain that filled the limits of the exploratory opening, rupturing or disintegrating the brain substance before a closure of the scalp and muscles could be effected. Only one case in our series has survived where early exploration was necessitated in the presence of a combined subdural and subarachnoid bleeding. On the other hand, the patients in whom the subdural hæmatoma was explored after the seventh to tenth day, when signs of intracranial pressure had disappeared, made prompt and satisfactory recoveries.

The surgical indications, therefore, in head injury, are, in our opinion, clearcut.

1. Compounded, comminuted fractures require early local débridement and care of the wound.

2. Focal epidural or subdural hæmatomata require exploration at site of focal neurologic signs and not at point of fracture.

3. Decompression is a measure of last resort after all other methods have failed.

Frequent and continued spinal drainage in cases of bloody cerebrospinal fluid not only withdraws the overaccumulation of cerebrospinal fluid, permitting better cerebral circulation, but removes to some extent the red blood cells which are active in producing pachymeningitis and arachnoiditis, the consequences of which become manifest in the posttraumatic sequelæ. The strict limitation of the fluid intake to prevent cerebral œdema and cerebrospinal fluid formation must be maintained during the first 10 days, and when bloody spinal fluid is encountered, 30 total ounces of liquid are permitted the patient, and a solid, dry diet maintained (Fig. 4). This is ample fluid to maintain the necessary physiological requirements and permits the withdrawal of an accumulation of from 45 to 60 cubic centimeters of spinal fluid daily. If liquid diet or fluid in greater quantity is given, an excessive amount of cerebrospinal fluid is formed and the patient's symptoms of stupor return requiring that the emergency measures of dehydration be repeated. If the spinal fluid is clear and there is no necessity, after the first spinal drainage, for further daily spinal fluid withdrawal, the patient is allotted 20 total ounces of liquid, so as to prevent the formation of spinal fluid and cerebral œdema.

It has been found in our series that patients maintained on a solid, dry diet and 20 total ounces of fluid per day promptly regain consciousness, are free from headache, and little or no spinal fluid can be obtained after the second day. This places the cerebral mechanism in a physiological state of rest, free from hydraulic compression, and permits the optimal cerebral circulation during the period of recovery; it shortens the interval of unconsciousness, and preserves the higher centers of intelligence. After discharge from the hospital (patients with severe cerebral trauma, with or without bloody spinal fluid), the patient is placed upon a total of 32 ounces of liquid per day for the ensuing 3 months. The diet should contain solid foods, and strict avoidance of vegetables, high in water content, or excessive volumes of food, should be emphasized. In this series of observations, the

patients have shown rapid improvement following cerebral injury, and have been free from headache, loss of initiative, memory disturbance, and mental fatigue, so common in the former group. They have returned to full activity in many cases within 3 months of the injury, where formerly a nine months' period of disability was to be expected. The patients have maintained a low fluid level of their own accord. "When they took more liquids they did not feel as well"; they had headache, and dulness, and voluntarily returned to their former restrictions of fluid and diet.

Encephalography (3) has clearly shown that widespread cortical atrophy of the brain occurs within 3 weeks following cerebral trauma. Many post-traumatic cases have shown not only focal scars over the cortex of the brain, but an atrophy out of proportion to the site of injury or its extent, and this atrophy of the cerebrum and cerebellum is bilateral and generalized. Pathologically such brains reveal anæmic changes and degeneration similar to that described by Hassin (2) and termed *pressure atrophy*. An atrophy of the soft delicate gray matter of the brain is not surprising in view of our observations regarding pressure atrophy elsewhere in the body. When a ring is worn upon the finger; when glasses rest upon the nose, or exert pressure upon the cartilage of the ears; when casts or constricting bandages are applied to the surface of the body, characteristic pressure atrophy occurs. The results of pressure from a cast applied to the extremity and the rapid consequent atrophy are readily recognized and accepted by the profession. The fact that the brain is acted upon by an "hydraulic cast" encased by an unyielding skull seems to have escaped the recognition which it should have had from the profession.

The obstetrician depends upon hydraulic pressure for dilatation of the cervix in normal labor. The hydraulic atrophy produced in distention of the bladder and renal pelvis is well recognized. The control, therefore, of a similar cerebral hydraulic mechanism is necessary to prevent widespread atrophy of the cortical surfaces surrounded by fluid (Fig. 3).

It is evident that the members of our profession interested in industrial medicine and the economic readjustment of patients suffering from head injuries must secure the early protection and subsequent preservation of the cortical areas so necessary for intellectual activity. The cerebral hydraulic pressure mechanism should be treated in the same manner in which one would deal with an obstruction to the neck of the bladder or renal pelvis; that is, continued and prolonged fluid drainage must be the first consideration, and the accurate control of fluid production should be maintained during the period of inadequate elimination. Thus, in attacking the problem from both angles, we shall not continue the paradoxical treatment so long in vogue of draining the spinal canal or decompressing the brain, only to follow this beneficial procedure by immediately introducing large quantities of fluid into the individual by mouth, bowel, or vein, destroying the advantages gained through cerebral decompression.

The fact must not be overlooked that surgical decompression as practiced formerly, only extends the limits of the confining skull and dura to permit the necessary expansion of the cerebral tissues, so that circulation may be adequately maintained to the vital centers. If the fluid volume is withdrawn from within the cranial cavity, a more adequate decompression is maintained than that which surgery may offer, as, at best, a subtemporal decompression is equal to approximately 90 cubic centimeters of volume space permitted by expansion of the brain into the new decompressive opening. If 3 ounces (90 cubic

TABLE I.—CASE ANALYSIS

	Cases	Per cent
Total cases of head injuries admitted to hospital	224	....
Cases with bloody spinal fluid	104	46.4
Proved fracture of skull by X-ray	56	25.0
Surgical decompression	11	4.9
Total deaths	41	18.3
Deaths after third hour of treatment	29	12.5

TABLE II.—ANALYSIS OF DEATHS

	Cases	Per cent
Total deaths	41	....
Died within first 3 hours of admission	12	29.2
Died of complications (ruptured liver, thorax, meningitis, etc.)	11	26.8
Surgical decompression deaths	10	24.3
Died after third hour from cerebral injury alone in spite of treatment	8	19.5

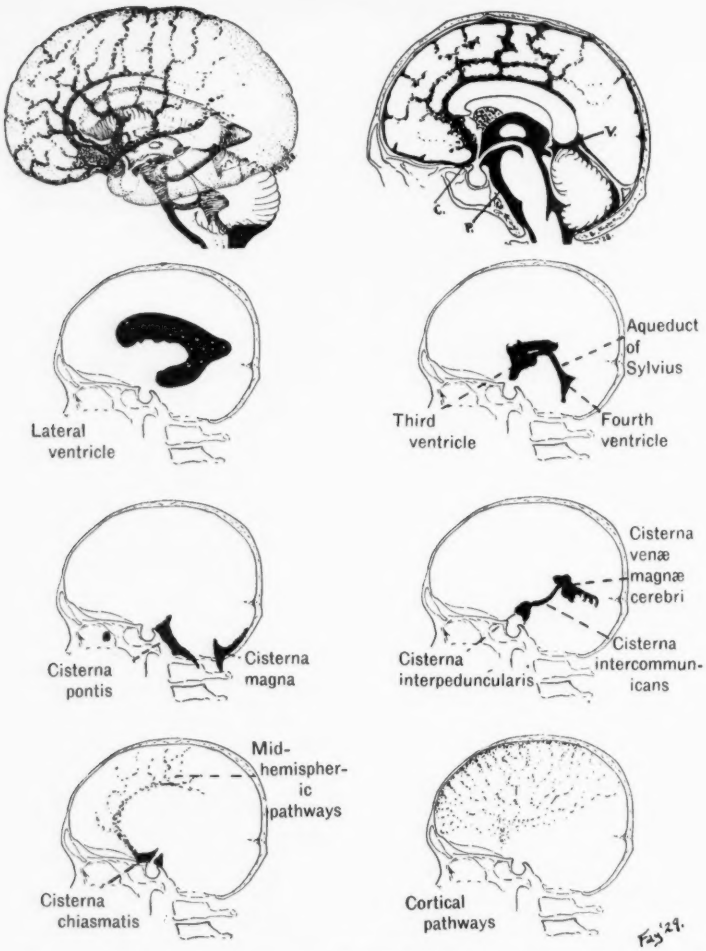

Fig. 3. A diagrammatic relationship of the spinal fluid pathways to the surface of the brain. In the post-traumatic the greatest cerebral atrophy occurs in the areas surrounded by the hydraulic cast composed of cerebrospinal fluid.

centimeters) of volume space is all that is necessary, the patient will naturally survive and be benefited by the decompression. However, too frequently the added space granted the cerebral contents is rapidly filled by the œdematous brain and accumulations of spinal fluid secondary to unrestricted liquid intake. Curtailment of fluid intake, repeated spinal drainages, and dehydrating hypertonic solutions, on the other hand, will usually control the volume of œdema within physiological limits, without the necessity for surgical decompression and without the danger of further injury to an already traumatized sensitive cerebral mechanism.

To eliminate decompressions in the treatment of head trauma is to step further forward toward assisting in the industrial and economic readjustment of the patient, because brain destruction and atrophy invariably occur at the site of surgical decompression, whether inflicted at the time of surgical inter-

Fig. 4. Clinical chart indicating the important considerations during the first 2 weeks following a severe cerebral trauma. Note that no fluids were permitted the patient during the first 2 days. Black columns represent total intake of fluid. Gray columns total output. Black squares, pulse pressure; gray dots, pulse rate; arrows indicate spinal drainage. On the fourth day, 34 ounces of fluid intake produced crossing of pulse rate and pulse pressure requiring further dehydration. On the seventh day water surreptitiously obtained, was followed promptly by rise in pulse pressure and fall in pulse rate, with stupor. Spinal drainage re-introduced. After the tenth day the patient was able to take 50 ounces of fluid without further intracranial pressure disturbance. Note water storage during this period, indicated by low output.

vention, or subsequent to the pressure exerted at this point of opening. This leaves the patient with an organic loss of brain in the region of the decompression, superadded to the loss directly due to the injury itself. Not only is this a most important compensation factor, but a definite inferiority complex develops, characterized by fear and anxiety because of the opening in the skull, and this produces a typical post-traumatic psychosis. Finally, such disfiguring decompressive openings limit the patient in his possibilities of securing work or engaging in activities that offer the slightest danger of trauma to the site of the cranial defect.

In summarizing the important industrial and economic aspects of head injuries, I wish to emphasize that early and continued dehydration as a form of decompression should be immediately instituted and continued to the point of recovery of conscious function. The hydraulic compression from chronic, in-

creased intracranial pressure should be controlled for a period of months following cerebral injury to prevent the increase of brain atrophy so characteristic in this group. The symptoms of post-traumatic headache, vertigo, mental torpor, mental deficiency, loss of initiative and concentration may frequently be prevented if careful supervision and control of fluid intake have been maintained from the time of injury. Finally, surgical intervention in traumatic injuries to the brain is distinctly limited to focal lesions and to the necessities for local débridement. Routine and indiscriminate surgical decompression as a method of treatment is no longer justifiable in the presence of newer physiological means at our disposal, which not only benefit the patient to a greater degree but eliminate further injury and complications attendant upon surgical decompressions of the brain during the acute intracranial pressure phases.

In order to meet the growing industrial and economic dependency that these cases place upon the profession and society as a whole, it is necessary to undertake the measures of prevention and relief during the early hours following the trauma.

It is only by initiating a program of protective measures, directed toward the gnostic as well as the vital centers, and placing the responsibility for maintaining these squarely upon the shoulders of the attending clinician that there is any hope of checking the enormous economic and social losses sustained each year, arising from the problem of intracranial injuries.

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SPONDYLOLISTHESIS[1]

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IN a conference on industrial medicine and traumatic surgery, physicians will find that subluxation of the lumbar vertebræ, or spondylolisthesis, is becoming of increasing significance as a factor in chronic backache. Physicians who are called on to fix responsibility for disability, to determine its extent and duration, and to relieve symptoms of backache, should always be alert to the possibility of spondylolisthesis being present. I am convinced that this deformity is not generally recognized, that it is more common than has hitherto been supposed, and that future study will prove its increasing significance in relation to chronic, disabling backache with or without associated injury (Table I).

Killian, in 1853, recognized spondylolisthesis as a clinical entity. He named it spondylolisthesis, and believed that it was due to caries and inflammation. Blake, in 1866, reported the first case in the United States. The patient was a multipara, aged 26 years, who had gained 100 pounds in weight. Neugebaurer, in 1884, after a study of all anatomic museum specimens available, although recognizing defects in development, regarded injury as the principal cause. Lovett, in 1897, reported the first case of traumatic spondylolisthesis. Gibney described the case of a male patient, and this with Lovett's case was among the first 6 cases of male patients in 125 cases described previous to 1900 (Table II). The fact that in The Mayo Clinic 5 cases of this type were recognized in a month in 1931, and only 1 case was recognized in 1921, and that males (71 per cent) outnumbered the females (29 per cent) (Table III) contradicts the older teaching that spondylolisthesis is rare and is found mostly among women.

Farmers, laborers, and housewives constituted about 64 per cent of the 207 patients with spondylolisthesis observed in The Mayo Clinic. No doubt trauma is an etiological factor in spondylolisthesis, but obesity, pregnancy, and occupational strain may gradually bring on the condition. The patient may not associate the injury with the complaint because it was sustained months or even years previous to the onset of symptoms. Sudden, severe injury may instantly disable the patient because of pain following subluxation. An increasing number of congenital defects of the fifth lumbar vertebra and first sacral vertebra, which apparently had not caused symptoms, is being observed in examinations made as a routine. When trauma tests the stability of these structures, displacement may occur; pain results from abnormal posture and weight bearing, strain on the ligaments, nerve stretching or pressure with muscle spasm and fatigue. A congenital defect could exist a lifetime without a patient's knowledge; even subluxation to a considerable degree could exist without symptoms (Table IV). It is my opinion that trauma is the exciting cause of spondylolisthesis, but that underlying it in most instances there is a defect in the lumbosacral region. Amazing changes in the lumbosacral angle and lordosis are further contributing factors (Fig. 1). Unfortunately, these anomalies have not been recognized frequently in the past. With modern methods of roentgenography, they are more easily recognized, and spondylolisthesis is more readily distinguished from arthritis, tuberculosis of bones, or fracture.

Ordinarily, strong, ligamentous supports hold the inferior articular process of the fifth lumbar vertebra from slipping over the superior articular process of the sacrum, and in the absence of fracture or defect about the neural arch they prevent rotation and forward displacement. Evolutionary changes, assumption of the upright or perpendicular from the horizontal posture, and the late closure of the neural arch, have made defects, such as separation through the neural arch, and spina bifida occulta exceedingly common. I use the term separation about the neural arch, as it may be congenital or traumatic and vary in

[1]Presented in the Conference on Industrial Medicine and Traumatic Surgery, Clinical Congress of the American College of Surgeons, New York, October 12–16, 1931.

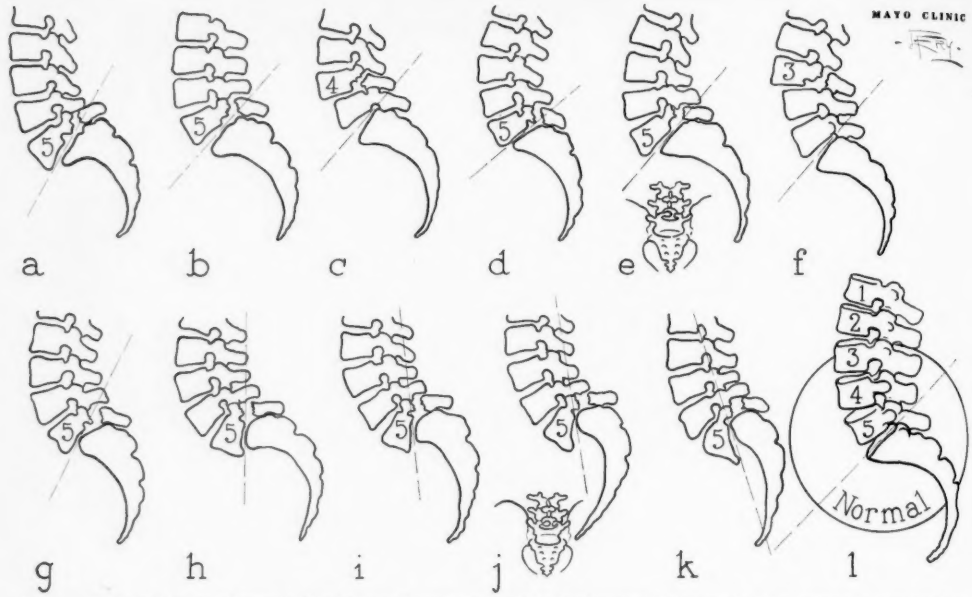

Fig. 1. Principal types of spondylolisthesis and variations of the lumbosacral joint made from roentgen-ray tracings. The lumbosacral angle varies fully 60 degrees; the sacral articulation may be rounded and the fifth lumbar vertebra concave. The forward displacement varies from slight to complete. Separation of the laminæ is common.

situation. Age also may be a factor; in The Mayo Clinic series there were no patients aged less than 10 years, but roentgenograms were referred to me of 1 patient aged 5 years. The average age of patients in this series was 40 years; 80 per cent were between the ages of 20 and 60 years (Table V). Thus, patients engaged in heavy work, and in the active period of life come for relief most frequently.

The chief complaint of patients with spondylolisthesis is backache, often accompanied by referred pain to the sacro-iliac joints, the hips, thighs, legs, and even the feet (85 per cent). No doubt many cases of so called sacro-iliac strain are in reality the result of injury to the lumbosacral articulations in which there are no lesions visible grossly or roentgenologically. Weakness and numbness, or a tingling feeling of the legs, may be present. Stiffness of the spinal column, especially limited forward bending, is usually present. Muscle spasm is common. Deformity, such as prominence of the sacrum, lordosis, depression of the lower lumbar vertebræ, shortening of the torso, and broad pelvis are rarely noticed by the patients, unless called to their attention. Decrease in height was noted by a few patients. In the typical case, the complaint is backache, slight disability, especially for hard work such as lifting and stooping, and slight weakness and stiffness of the spine, with relief of symptoms in a recumbent position. The average duration of symptoms in the series of 207 cases was 8.76 years, yet in only a small percentage had diagnosis been made (Table VI).

Clinical diagnosis was usually made by inspection and palpation of the back (Fig. 2); the depression above the sacrum with sway back, muscle spasm, and prominent sacrum, was almost enough evidence. A shortened torso, with broad pelvis, prominent erector spinæ muscles, and abdominal crease, appeared with well marked spondylolisthesis. In extreme deformity the ribs may rest on the pelvis, and the patient will walk with the waddling gait that suggests congenital dislocation of the hips. Proctoscopic examination and careful palpation may disclose a hard, fixed mass in front of the sacrum, that nar-

TABLE I.—CHIEF COMPLAINTS—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

	Cases
Backache	101
Backache and pain in legs	35
Backache and pain in thighs	25
Backache and pain in hips	15
Pain in legs	11
Weakness in 10 cases; numbness in 30.	
Other complaints (spondylolisthesis incidental findings)	20
Total	207
Average duration complaint	Years
Male	7.88
Female	9.64

TABLE II.—CASES OBSERVED—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

Year	Cases	Registration, per cent
1918	2	0.004
1920	1	0.001
1921	2	0.003
1922	5	0.010
1923	5	0.008
1924	4	0.006
1925	14	0.020
1926	14	0.019
1927	17	0.023
1928	21	0.027
1929	35	0.044
1930	41	0.054
1931	46	0.092
Total	207	0.023

rows the birth canal. Jarring and jolting the spinal column may cause pain; patients usually walk carefully. Although the foregoing clinical observations are sufficient to make a diagnosis, roentgenograms, especially lateral views, are of great aid in determining accurately the degree of spondylolisthesis and the presence of anomalies, and in excluding tuberculosis, fracture, arthritis, and so forth. Anteroposterior roentgenograms cannot alone be depended on for the diagnosis of subluxation, although the shortened lumbar portion of the spinal column, the fifth lumbar vertebra superimposed on the sacrum, and the cocked up spinous processes, are strongly suggestive. By lateral roentgenograms the degree of subluxation may be graded 1, 2, 3, and 4 (Fig. 3). The condition of the neural arch, whether fractured, elongated, or defective congenitally, the shape and size of the fifth lumbar vertebra, the condition of the lumbosacral joint, as to angle and shape of the sacral

Fig. 2. Limited forward bending; depression and lordosis of the spinal column, with prominence of the fifth lumbar vertebra spinous process and sacrum in an adult patient with spondylolisthesis.

promontory, whether lipped or rounded, and so forth, should be noted.

Lateral roentgenograms should include the lumbar vertebræ and sacrum. The spinal canal should be carefully inspected as the displacement is more readily detected there, particularly the lesser displacements. The film is best studied with a moderate amount of light behind it; the spinal canal can be outlined with pencil on thin paper (Fig. 4).

Arthritis was the most common complication in the series; it occurred in about 20 per cent of the cases and was readily distinguished in carefully prepared roentgenograms and by the clinical history. Separation of the neural arch has been observed in as high as 70 per cent in a series of roentgenograms depicting definite spondylolisthesis. Spina bifida occulta of the first sacral vertebra is common (about 35 per cent). The fifth lumbar vertebra is commonly wedge-shaped, and the lumbosacral joint is misshapen with a lipped or rounded promontory of the sacrum (Table VII). Other diseases and deformities found associated in this series of cases were without significance. Arthritis occurred in 40 cases, which is no more than is to be expected at the average age of 40 years. Teeth were infected

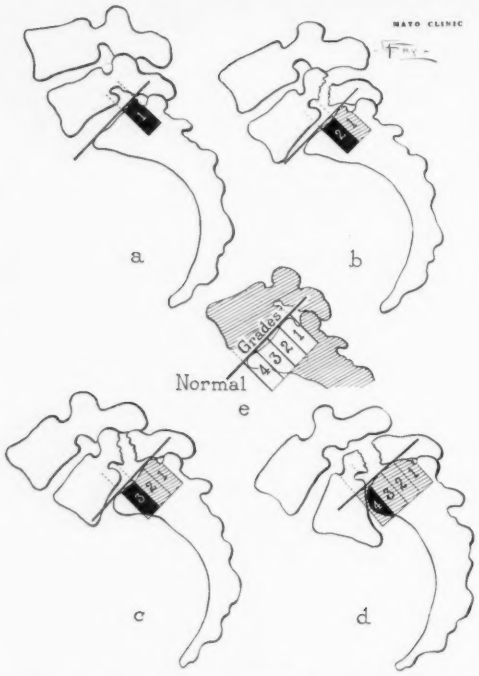

Fig. 3. Gradation of degrees of spondylolisthesis.

in 60 cases and tonsils in 64. Tonsillectomy had been performed in 37 cases. The Wassermann reaction of the blood was negative in 197 cases and positive in 3; the test was not made in 7 cases. Urinalysis was negative in 196 cases and positive in 11.

TREATMENT

In acute spondylolisthesis, traction and recumbency are indicated and afford relief. Attempts at reduction have not been successful in proved cases. Suspension by the legs with an overhead frame would seem logical. Treatment for 6 weeks on a firm mattress or with the legs in a double spica cast is often desirable. Later a body cast well fitted to the pelvis affords relief from pain and a sense of security. For obese patients a corset with posterior steel stays fitted well down on the sacrum is most satisfactory (Fig. 5).

Fusion operations, when operation is not contra-indicated, after the method of Hibbs or Albee, or combined as in my technique, is

TABLE III.—OCCUPATIONS—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

	Male	Female	Total
Farmers	48		48
Housewives		44	44
Laborers	39	1	40
Clerks	18	5	23
Students	9	5	14
Railroad employees	9		9
Professional	7	2	9
Indoor executives	7		7
Mechanics	4		4
Clergymen	4		4
Bankers	3		3
Teachers		2	2
Total	148	59	207

TABLE IV.—TRAUMA—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

	Cases
Severe	71
Mild	7
Repeated	3
Severe and repeated	4
Strain	10
Pregnancy	4
None	6
Not mentioned	102
Total	207

preferred for those who must work, and for the prevention of disability. I prefer to ankylose the third, fourth, and fifth lumbar vertebræ and the upper two segments of the sacrum by two grafts fitted to the sides of the denuded spinous processes and sacrum. The laminæ are exposed after the method of Hibbs, multiple bone chips and cancellous bone are packed between them and the spinous processes; the massive grafts are then held snugly against the freshened sides of the spinous processes by chromic catgut. A large osteoperiosteal graft taken from the tibia before removal of the massive grafts is then sutured over the posterior surfaces to cover the grafts and spinous process and sacrum. The wound is then closed without drainage and a heavy gauze dressing saturated with 70 per cent alcohol is applied and fastened by broad strips of adhesive plaster. The dressing is changed after a few days and one of dry gauze is applied. Care should be taken to have proper hæmostasis, as infection may occur with drainage of the hæmatoma and present a serious complication. A cast is not used after operation until the sixth week,

TABLE V.—AGE AND SEX—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

Years	Male	Female	Total
10–19	14	5	19
20–29	27	10	37
30–39	43	15	58
40–49	26	12	38
50–59	28	10	38
60–69	8	6	14
70–79	2		2
80–89		1	1
Total	148	59	207

Average age male patients, 38.59 years
Average age female patients, 41.32 years
Oldest female patient, 80 years
Youngest female patient, 11 years

TABLE VI.—PREVIOUS DIAGNOSIS—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

	Cases
Spondylolisthesis	19
Traumatic spine	5
Tuberculosis of spine	4
Curvature of spine	2
Rheumatism	2
Sciatica	2
Lumbago	2
Tuberculosis of hip	1
Kidney trouble	1
Sprain	1
Fracture of neck of femur	1
Hernia	1
Backache	1
Fracture of pelvis	1
Not diagnosed	164
Total	207

TABLE VII.—SITE—JANUARY 1, 1918 TO SEPTEMBER 21, 1931

	Cases
Fifth lumbar vertebra on the sacrum	178
Fourth lumbar vertebra on the fifth lumbar vertebra	23
Third lumbar vertebra on the fourth lumbar vertebra	2
Reversed spondylolisthesis	4
Total	207

when patient may be permitted to be up, using a supporting jacket, corset, or brace. Operative results are good in properly selected cases.

SUMMARY OF ILLUSTRATIVE CASES

CASE 1. A stone mason, aged 46 years, complained of pain in the back, radiating into the hips and legs with occasional numbness. Thirty-two years previously he had sustained an injury to his back when a horse fell on him.

Examination disclosed limitation of motion of the spinal column, a shortened torso, and depression

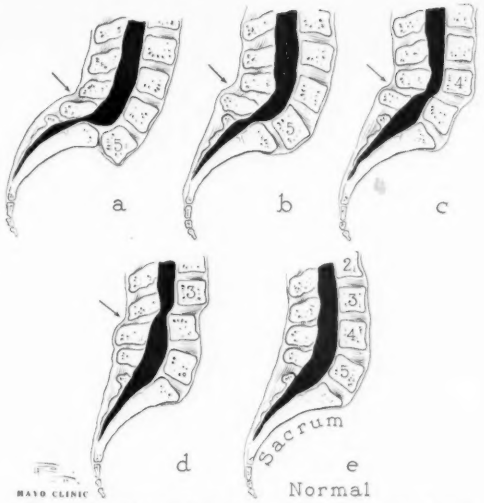

Fig. 4. Sagittal sections through the lumbosacral area, showing the effect of displaced vertebra on the spinal canal. a, spondylolisthesis (graded 3) of the fifth lumbar vertebra on the sacrum; b, spondylolisthesis (graded 2) of the fifth lumbar vertebra on sacrum; c, spondylolisthesis (graded 1) of the fourth lumbar vertebra on the fifth lumbar vertebra; d, spondylolisthesis (graded 2) of the third lumbar vertebra on the fourth lumbar vertebra; and, e, normal spinal canal.

above the fifth lumbar spinous process. The Wassermann reaction of the blood and urinalysis were negative. The tonsils and teeth were infected. Anteroposterior roentgenograms disclosed spina bifida occulta of the first sacral segment, and the fifth lumbar vertebra slightly superimposed on the sacrum. Lateral roentgenograms disclosed spondylolisthesis, graded 1, and a wedge-shaped fifth lumbar vertebra with narrowed fifth lumbar joint.

The patient was operated on in August, 1928; a double bone graft and multiple bone chips were used to fuse the third, fourth, and fifth lumbar vertebræ and the sacrum. Result was good (Fig. 6).

CASE 2. A farmer, aged 27 years, came to the clinic in April, 1925, complaining of pain in the back and legs, which had followed an accident 18 years previously. A diagnosis had not been made. The only treatment he had had was massage.

Examination of the back disclosed a short torso, prominent fifth lumbar vertebra and sacrum, and some limitation of motion, especially on forward bending. Urinalysis and the Wassermann reaction of the blood were negative. The patient appeared in good health otherwise. Anteroposterior roentgenograms revealed that the lumbar portion of the spinal column was shortened; the fifth lumbar vertebra was superimposed on the sacrum causing increased density. Lateral views revealed spondylolisthesis, graded 2, of the fifth lumbar vertebra on

Fig. 5. Postoperative anteroposterior view of region of fusion operation. Spondylolisthesis of the fifth lumbar vertebra on the sacrum 2½ years after operation.

the sacrum and separation of the neural arch; the spinous process of the fourth lumbar vertebra appeared to rest on the sacrum.

Patient was operated on in April, 1925. Bone was grafted to third, fourth, and fifth lumbar vertebræ and sacrum, with relief of symptoms (Fig. 7).

Case 3. A railroad fireman, aged 39 years, complained of aching pain in the back and legs with occasional numbness of the feet resulting from a 30-foot fall that had occurred 21 years previously. A diagnosis had not been made.

Examination of the back disclosed short torso, broadened pelvis, lordosis and depression above the fifth lumbar vertebra, and prominence of the spinous process of the fifth lumbar vertebra and sacrum. There was some limitation of motion of the spinal column, especially on bending forward. Anteroposterior roentgenograms revealed clearly the shortened lumbar vertebræ with the fifth vertebra

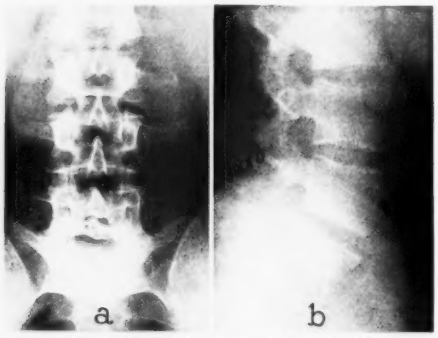

Fig. 7. Spondylolisthesis (graded 2) of the fifth lumbar vertebra on the sacrum; a, anteroposterior roentgenogram; b, lateral roentgenogram. Case 2.

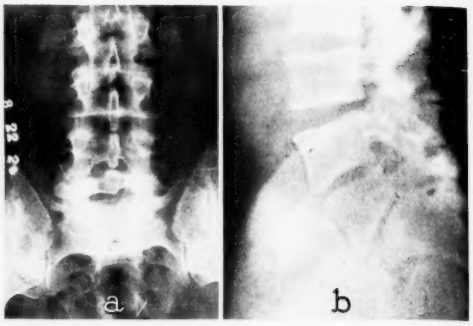

Fig. 6. Spondylolisthesis (graded 1) of the fifth lumbar vertebra on the sacrum; a, anteroposterior roentgenogram; b, lateral roentgenogram. Case 1.

superimposed on the sacrum, thus producing increased density. Spina bifida occulta of the fifth lumbar vertebra was shown. Lateral views revealed spondylolisthesis, graded 3, of the fifth lumbar vertebra on the sacrum, apparently a separate or bifid arch, rounded sacral articulation, and the lamina and spinous process pushed down on the sacrum. The posterior border of the body of the fifth lumbar vertebra rested just a little in front of the center of the articular surface of the sacrum. The lumbosacral joint was almost perpendicular. Patient refused operation (Fig. 8).

Case 4. A railroad fireman complained of backache and leg ache of 3 years' duration. Although he had fallen many times he did not directly associate the injuries with his pain. A diagnosis had not been made, although various forms of treatment had been given, including tonsillectomy.

Examination of the spinal column disclosed a short torso, slight scoliosis, depression above the fifth lumbar vertebra, and prominence of the sacrum and spinous process of the fifth lumbar vertebra. The Wassermann reaction of the blood and urinalvsis were negative. Roentgenograms revealed shortened lumbar vertebræ, fifth lumbar vertebra superimposed on the sacrum, spondylolisthesis, graded 4, perpendicular lumbosacral joint, spina bifida occulta, and separate neural arch. The spinous process and lamina of the fourth lumbar vertebra appeared to rest on the sacrum and the spinous process of the fifth lumbar vertebra was pushed back. Increased density of the upper part of the sacrum appeared as a result of the rays passing through part of the fourth and fifth lumbar vertebræ and sacrum. The articular surface of the sacrum was rounded.

The patient was at first opposed to operation and a body cast was applied, which gave him considerable relief. He returned later, and a fusion operation was performed in March, 1924, on the third, fourth, and fifth lumbar vertebræ and the sacrum with relief of symptoms (Fig. 9).

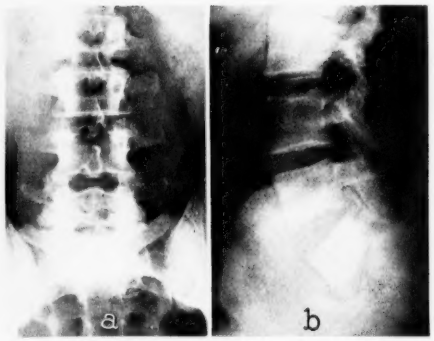

Fig. 8. Spondylolisthesis (graded 3) of the fifth lumbar vertebra on the sacrum; a, anteroposterior roentgenogram; b, lateral roentgenogram. Case 3.

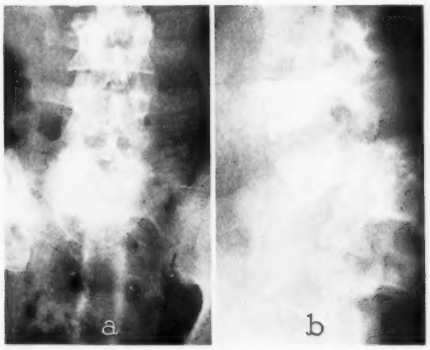

Fig. 9. Spondylolisthesis (graded 4) of the fifth lumbar vertebra; a, anteroposterior roentgenogram; b, lateral roentgenogram. Case 4.

SUMMARY AND CONCLUSIONS

The data in this series of cases, in contradistinction to that of older literature, show that spondylolisthesis is more common among male than female patients; in 207 cases, 148 were males and 59 were females. Patients aged less than 10 years rarely have spondylolisthesis; it is most common between the ages of 20 and 60 years. Persons performing heavy labor are more commonly affected; the average age of these is 40 years.

Spondylolisthesis is usually recognized and is no longer a rare deformity, as has been taught formerly. It may be present without symptoms. Severe trauma with sudden onset of symptoms and chronic strain with gradual onset of symptoms are associated. The principal symptom is backache with or without referred pain in the legs. Trauma is the principal etiological factor ascribed by many patients. Congenital defects and the instability of the lumbosacral articulation is the anatomical factor.

The lumbosacral articulation varies in shape and angle: the latter may be abnormal to the extent of 60 degrees, thus aiding in the production of instability. Subluxation varies from partial to complete and may be graded on a basis of 1 to 4, as an aid to description.

Prominence of the sacrum and the fifth lumbar spinous process is present to a varying degree. Shortened torso, depression above the sacrum, broadened appearance of the pelvis, and abdominal creases are characteristic of well developed subluxation. Depression of the fifth lumbar vertebra, local tenderness, and muscle spasm are common signs. The anteroposterior diameter of the pelvis is lessened, thus narrowing the birth canal. Rectal examination may disclose a fixed mass anterior to the sacrum.

Neurologic signs are usually absent; complete paraplegia is impossible at the level of the displacement (the lumbosacral joint), unless traumatic myelitis at a higher level occurs. Paræsthesia over the saddle area and referred pain are often present.

Lateral roentgenograms are valuable aids in diagnosis. Anteroposterior views may not disclose the lesion. Congenital anomalies, such as separation of the neural arch and spina bifida occulta, are commonly observed.

Conservative treatment, including the wearing of corsets, casts, and the like, gives a measure of relief, but fusion of the third, fourth, and fifth lumbar vertebræ to the sacrum is preferable; it prevents further deformity and increasing disability, it restores the patient's stability and well-being, and he is able to work.

LOCAL ANÆSTHESIA AS A FACTOR IN REDUCING THE MORBIDITY OF TRAUMATIC SURGERY[1]

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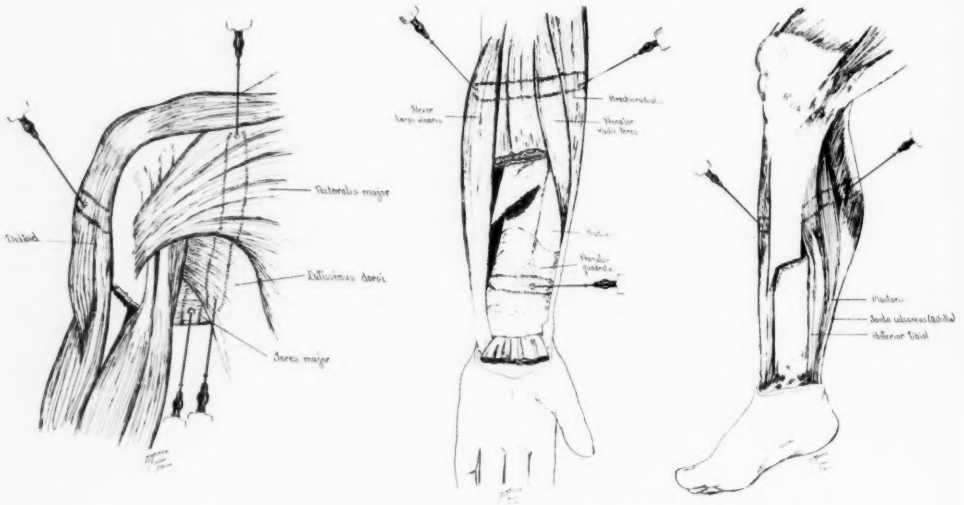
TRAUMATIC surgery is surgery of stress and as such the choice of anæsthetic should be carefully considered. We wish to emphasize the important rôle of local anæsthesia in reducing the morbidity of general surgery.

It is a law of surgery that every effort be made to preserve life, restore function, and erase the ravages of disease. The operative treatment does not always conclude this battle of mercy; the patient must continue the fight, often against additional odds induced by inhalation anæsthesia. Pitkin has shown the morbidity of inhalation anæsthesia to be 5 per cent at the operating table and 95 per cent during the week which begins 1 hour after the induction; that is, the secondary morbidity is 95 per cent of the total, the primary morbidity a meager 5 per cent.

The choice of the form of anæsthesia in the elective operation for chronic disease demands careful consideration. In the urgency of traumatic surgery this consideration of the anæsthetic is often lacking, and the possibility of local anæsthesia is overlooked by many surgeons. Given a case of emergency surgery in any region of the body, the choice of anæsthetic often is lightly considered; routinely the patient is given one of the standard general anæsthetics. The anæsthesia is usually satisfactory, the operation is completed, and the patient is returned to his bed, having safely passed the immediate dangers attending its administration. The indirect later dangers, constituting the 95 per cent of Pitkin, such as postoperative shock, vomiting, dehydration, acidosis, alkalosis, pulmonary complications, distention, ileus, renal suppression, and pain, are yet to be faced. It is granted that these indirect complications may not be charged to the general anæsthetic; certainly the operative lesion and operative technique must be included. Yet in a broad sense, the anæsthetic is an important factor since under local anæsthesia operative technique is gentle and meticulous, affording a methodical approach by



Figs. 1 to 3. Demonstration of intramuscular injections for the reduction of fractures.

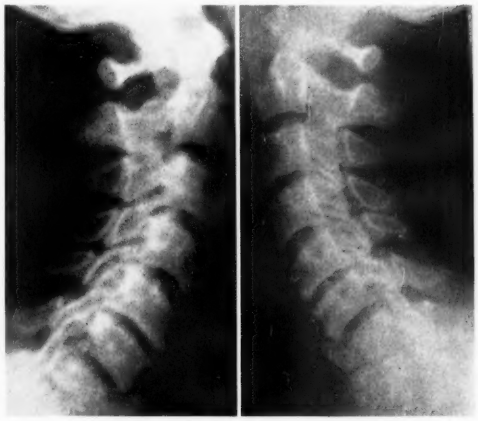
[1]Presented in the Conference on Industrial Medicine and Traumatic Surgery, Clinical Congress of American College of Surgeons, New York, October 12–16, 1931.

which the operative lesion may be safely attacked without trespassing upon brain or uninvolved parts.

Local anæsthesia long ago passed the experimental stage. It is now generally accepted that its scope may include any operation. It is not a surgical fad, but a most valuable aid to surgery. An enthusiastic conviction obtained from year after year of general surgery performed almost exclusively under local anæsthesia has led me to relegate general anæsthesia to that small percentage of cases in which some type of local anæsthetic may not be successfully employed. The comfort and safety of the patient and the success of the operations have so consistently improved that for over 6 years more than 99 per cent of our cases have been primarily scheduled for local anæsthesia.

The United States Naval Hospital at Great Lakes is a general hospital for the care of active and retired Navy personnel and for a large number of referred Veteran Bureau patients. There was a daily average of 683 patients during the past two years (with 6,792 patients admitted and 6,665 discharged during the past 19 months). From January 1, 1930, to September 1, 1931, 2,043 operations were performed by the general surgical service. Local anæsthesia was induced in every case, and only 8 required the addition of inhalation anæsthesia (see Table).

Lundy gives the following points as the preliminary considerations for determining the choice of an anæsthetic: first, the mental and physical condition of the patient; second, the proposed operation; third, the technique of the surgeon; and fourth, the experience of the anæsthetist. We agree with him in his conclusion: "No agent or method has been developed which can be used as a routine without danger." We feel that local, regional, or spinal anæsthesia may be made the basis for the safest anæsthesia by the careful selection and combination of local methods with the temporary addition of an inhalation agent when necessary We employ the term



Figs. 4 and 5. Fracture of body, seventh cervical vertebra. Full recovery following 3 months' immobilization in doll plaster cast. Anæsthetic not necessary.

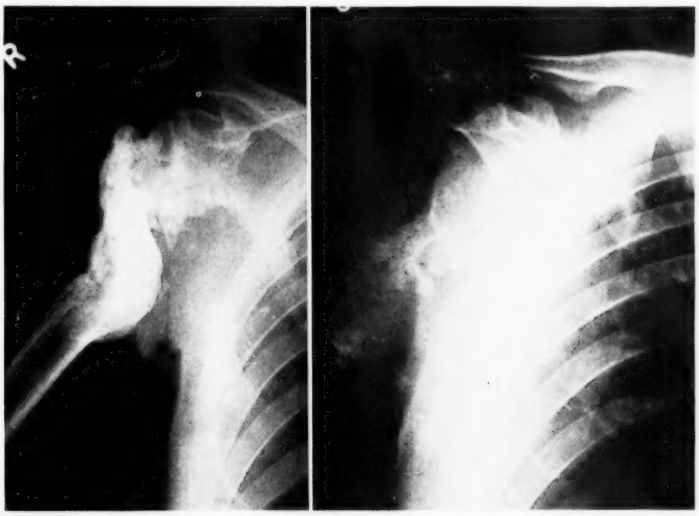


Fig. 6, left. Osteomyelitis right arm with ankylosis of shoulder joint.
Fig. 7. Healthy amputation stump following disarticulation of arm. Brachial anæsthesia.

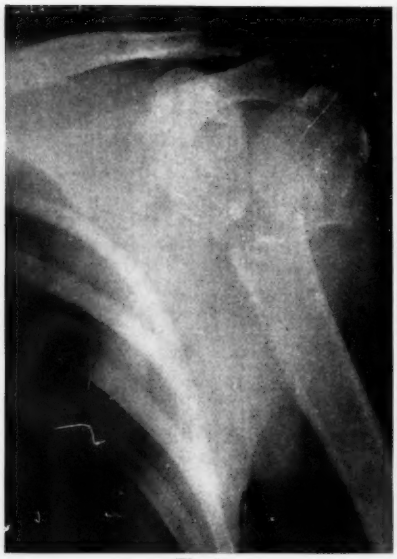


Fig. 8.

Fig. 9.

Fig. 12.

Fig. 13.

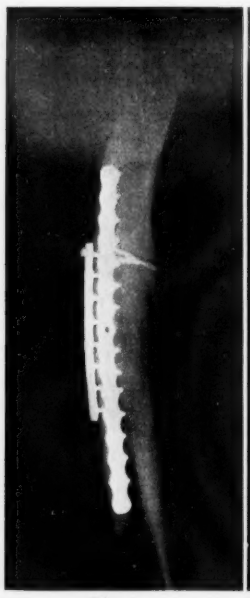


Fig. 14.

Fig. 15.

Fig. 8. Fracture dislocation surgical neck of humerus,
Fig. 9. Open reduction with excellent recovery. Regional block and intramuscular injections.
Fig. 12. Comminuted fracture femur.
Fig. 13. Reduction and union under spinal analgesia.

Fig. 14. Multiple draining sinuses from fracture site right femur. Strong union maintained since 1915 by 16 screw and 8 screw Lane bone plates. First sinus in 1924.
Fig. 15. Arrest of infection and healed wound following removal of bone plates. Spinal analgesia.

Fig. 10. Fig. 11.

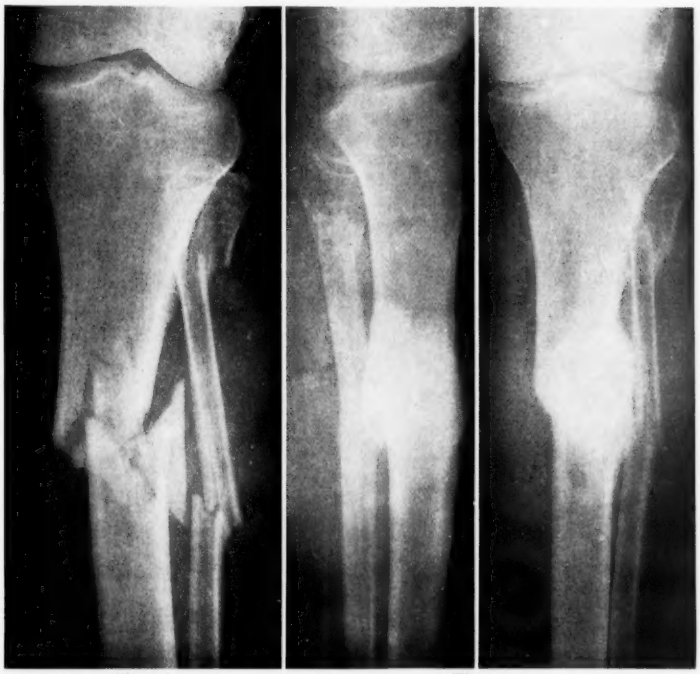


Fig. 16. Fig. 17.

Fig. 10. Fracture of olecranon process.
Fig. 11. Union and functional recovery. Regional block and intramuscular injections.

Fig. 16. Comminuted fractures tibia and fibula.
Fig. 17. Strong union following reduction by skeletal traction. Low spinal analgesia.

Fig. 18, left. Fracture left ankle with displacement of fragment into joint.

Fig. 19. Complete functional recovery following excision of fragment. Regional block anæsthesia.

Fig. 20, left. Multiple fractures of the right and the left os calcis.

Fig. 21. Functional recovery with simple immobilization. Anæsthetic not required.

local anæsthesia to include local infiltration, regional field and nerve blocking, and spinal anæsthesia. By combining local infiltration with field blocking, or operative zone infiltration with low spinal induction, we have been able to restrict inhalation anæsthesia to a small percentage of cases, and then only for a temporary period during difficult manipulations. We use only procaine hydrochloride in strength of ¾ per cent combined with a small amount of epinephrin (4 to 6 minims of 1:1000 solution to each 100 cubic centimeters of procaine) or ephedrin. For spinal anæsthesia we dissolve the procaine in spinal fluid and limit the dosage to 1 milligram for each pound of body weight. We have found local anæsthesia adaptable to all types of patients, with the exception of children under the age of reasoning.

UNITED STATES NAVAL HOSPITAL, GREAT LAKES, ILLINOIS—OUTLINE OF GENERAL SURGERY FROM JANUARY 1, 1930, TO SEPTEMBER 1, 1931

Classification of operations	Number	Type of Anæsthesia						Mortality	
		Local infiltration and regional block	Local infiltration and spinal analgesia	Straight spinal analgesia	Caudal block	Temporary addition of inhalation agent	Straight general anæsthesia	Immediate anæsthetic or operating room death	Post-operative deaths
Surgery of head and neck	198	198	00	00	00	00	00	00	2
Surgery of chest	105	105	00	00	00	00	00	00	0
Surgery of abdomen	1254	751	41	76	386	8	00	00	7
Genito-urinary surgery	134	85	00	19	30	00	00	00	1
Surgery of bones, joints, muscles and tendons	219	181	00	38	00	00	00	00	2
Surgery of the blood and lymph systems	133	133	00	00	00	00	00	00	0
Totals	2043	1453	41	133	416	8	00	00	12*

*The 12 deaths were due to: Genera l Peritonitis 2; Osteomyelitis, chronic 1; Hyperthyroidism 2; Carcinoma 2; Tuberculosis of kidney 1; Tuberculous Pelvic Abscess 1; Gangrene, leg 1; Gastric Hemorrhage 1; Mesenteric Vascular Occlusion 1.

The female patient has responded to the use of local anæsthesia just as well as the male, and as operating surgeon at the Veteran Bureau Hospital for the Insane I have found that insane patients are surprisingly good subjects. Under local anæsthesia we have had no operating room mortality, no death from anæsthetics, no primary shock or accident.

We consider the induction of spinal anæsthesia to be a major procedure and feel it should not be routinely and freely employed. The widespread recent popularity of spinal anæsthesia is not without danger. The proposed operation should exceed in gravity and importance the anæsthesia induced; hence we disfavor the routine employment of spinal anæsthesia in appendectomy, repair of hernia, rectal, and minor genito-urinary cases. We favor spinal anæsthesia and employ it freely when the disease is of sufficient gravity to justify the important measures necessary for its safe administration. It is not foolproof and should be employed cautiously in patients with definite cardiac disease, hypotension, marked asthenia, and in advanced age. It should be used only when the field of operation is below the diaphragm. Local infiltration and regional field block carry no such restrictions and may be employed safely in any zone of the body.

It is accepted that general anæsthetics disturb the chemistry and metabolism of the body. Bloor has shown that chloroform and ether, acting as fat solvents, produce a very definite increase in the fat content of the blood stream during prolonged anæsthesia. This condition is enhanced by pre-operative starvation and postoperative vomiting. This metabolic disturbance does not occur with local anæsthesia; the pre-operative preparation does not require withdrawal of food, preliminary catharsis is not needed, and the morning meal is permitted.

Vomiting, which is so common following general anæsthesia, is a rare occurrence after the use of local anæsthetics, and when present is seldom severe or prolonged. It may prove an annoying factor during the operation under spinal anæsthesia, but usually may be readily controlled by the use of oxygen.

Dehydration, or the loss of body fluids, due primarily to the organic lesion and accentuated by prolonged general anæsthesia, may produce serious concentration of the blood with resulting disturbed metabolism and production of an acidosis, ketosis, or alkalosis. Local anæsthesia, limited to the pathological or traumatized zone, adds little or no extra burden. Fluids and food are permitted early, and metabolism may be kept in equilibrium from the first day of operation.

Pulmonary complications occur following local anæsthesia, but to a far lesser degree in severity and frequency than after inhalation anæsthesia. There were no cases of lobar pneumonia in the above series. A productive

bronchitis occurred in 3 per cent of the abdominal cases; none was severe, and rapid recovery took place within the first week. Massive collapse of the lung occurred twice with spontaneous recovery under simple postural treatment. There was no case of lung abscess. Simple postoperative instruction to the patient, awake and alert in the operating room, to expand his lungs and to breathe deeply at hourly intervals has diminished our pulmonary complications.

The silent abdomen so nicely experienced in abdominal operations under local anæsthesia permits gentle methodical approach and mobilization of the lesion, lessens traction and manipulation of uninvolved parts, and results in minimum operative trauma. The incidence of distention and gas pains is reduced markedly. In the above series paralytic ileus occurred only twice with prompt relief by gastric lavage. Our surgical ward has lost the notorious postoperative days of stress, hours of discomfort, and danger to the patient—a period often testing the skill and patience of doctor and nurse. At Great Lakes we are able to group our postoperative patients in wards of 32 beds, and the postoperative ward requires for efficient care only one nurse and four corpsmen in daily attendance, and but two attendants at night.

Renal suppression of clinical note did not occur in this series. Catheterization has been markedly reduced, but not eliminated.

Postoperative pain is chargeable to many factors. The operative site, oddly enough, may not be the seat of serious pain for here there is usually only a receding zone of tenderness or ache, aptly described as a bruise. The patient who has been given a general anæsthetic is subjected to the strain of confining straps upon the operating table. He knows nothing of the struggles, delirium, gagging and suffocation while under the anæsthetic and wonders why he feels as though he had been in a football scrimmage. Contrast this experience with that of the patient under local anæsthesia, alert to his own comfort, with freedom to move and shift his position to one of relative ease. He leaves the operating room mentally and bodily at ease, cheerful in the knowledge that he has co-operated in the operation, and pleased that his adventure has dispelled his old horror of the surgeon and of the operating room.

The treatment of fractures, dislocations, severed tendons, and traumatic wounds falls easily within the scope of local anæsthesia. Here again the morbidity is reduced by confining treatment to regional parts.

The reduction of a fracture is a mechanical problem. The restoration of good alignment and apposition of the fragments is largely dependent upon control of muscular relaxation. General anæsthesia gives only transitory relaxation; casts, splints, and traction must be depended upon to maintain the hurried reduction, often through postanæsthetic delirium and the indefinite period of overpowering muscular effort in traction fatigue and atrophy of disuse. Local anæsthesia favors a rational reduction based on the fracture site and the all important associated mechanics of muscular contractions. The intramuscular injection of procaine into the bellies of the contracted muscles with a regional block of the sensory nerves produces a combined analgesia and deep muscular relaxation that permit reduction under the fluoroscope. The patient serves as an ideal assistant, ably co-operating in shifting position and making countertraction when necessary. There is no pain and the analgesia persists 2 to 4 hours after the reduction. Most important is the sustained relaxation of the muscles which in major fractures may be controlled indefinitely by repeating the intramuscular injections. Brachial anæsthesia will control any fracture or dislocation of the upper extremity, but, unfortunately, this method of anæsthesia demands a delicate technique in reaching the plexus that is not always attained. The regional block and intramuscular injections give longer relaxation. Spinal anæsthesia is the anæsthesia of choice for fracture of the pelvis and femur. Below the knee the sensory block and intramuscular injections are indicated as the muscular attachments and contractions are readily reached. The above types of local anæsthesia are indicated in open, as well as closed, reductions. A larger percentage of closed reductions is possible as the sustained relaxation of the muscles involved and the very important aid

rendered by the co-operation of the patient makes possible good reduction and later maintenance in simple fixation and traction splints. The reduction in morbidity is obvious. The primary and secondary dangers of anæsthesia are reduced to the remote possibility of local infection, nerve trauma, and emboli, which are factors that we have not encountered. The period of hospitalization is reduced, and the ambulatory class of fractures is much increased. The patient witnesses the reduction and from the start becomes an able, interested assistant.

Traumatic wounds, especially those involving severed tendons and nerves and amputations, are excellent cases for the use of local anæsthesia. Here again the patient serves as an efficient assistant by co-operating in the voluntary manipulations of the traumatized lesion. Difficult identifications of tendons, nerves, and important structures are made easier. Restoration of function is seen at the close of the operation. As in the treatment of fractures, we have noted the relaxation following the intramuscular injection of procaine. McNealy and Lichtenstein have shown that intramuscular injections of novocain prevent the reception of nerve stimuli by acting on the motor nerve end-plates. Recently severed tendons without loss of substance seldom require repeated postoperative injections to limit undue tension on the suture line as the relaxation at the primary repair permits strong suturing without tension. In severe cases of retracted tendons or loss of substance, the repeated injections, as reported by McNealy and Lichtenstein, appear justified.

The attending shock and associated morbidity in major wounds requiring amputation are controlled and lessened by regional anæsthesia. The hurried amputation with possible undue sacrifice of tissue is not seen under local anæsthesia, and an orderly plastic amputation may be regularly performed.

Wounds heal kindly following local anæsthesia. The use of procaine does not delay wound healing, and there is little or no resulting transudate, while cosmetic scars are easily obtained. Employed in the usual combination with epinephrin, the injections produce only a pressure sensation following the fleeting needle prick of the skin and contact with the regional nerve endings. Even local infiltration carried to an excessive degree of œdematization is readily absorbed and leaves only a dilatation of the capillaries as an epinephrin reaction. The suture lines are protected by the relaxation and protracted physiological rest of the regional muscles so that postoperative repair is hastened. Local anæsthesia demands gentle operative technique, and thus a minimum degree of operative trauma results. It is axiomatic that wound infection decreases as respect for tissue increases.

The time allotted will not permit detailed discussion of anæsthesia and operative technique. Figures 1, 2, and 3 demonstrate the intramuscular injection of procaine in the reduction of fractures. Figures 4 to 21 carry explanatory notes showing the scope of local anæsthesia in surgery of bones and joints.

In conclusion, we cannot emphasize too strongly that traumatic surgery affords an ideal field for local anæsthesia. The advantages are great to both patient and surgeon. The development of local technique increases respect for tissue, the surgeon is requited, and the patient blessed by a gratifying reduction in postoperative morbidity. The current series of over two thousand consecutive general surgical cases show the extent and safety of the scope of local anæsthesia. The employment of intramuscular injection of procaine in the treatment of fractures is particularly emphasized, and it is hoped that the extension of the scope of local anæsthesia by the expedient combination of local infiltration with regional blocking, or in combination with spinal analgesia, may create critical comment.

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EDITORIAL

SURGERY, GYNECOLOGY AND OBSTETRICS

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FEBRUARY 15, 1932

THE 1931 CLINICAL CONGRESS

THE twenty-first annual Clinical Congress of the American College of Surgeons held in New York and Brooklyn from Monday, October 12, to Friday, October 16, 1931, was the fourth Clinical Congress held in these cities. In comparison with the three previous sessions—in 1912, 1919, and 1924—the twenty-first Congress may well be considered the most successful of all. The 1931 session was particularly noteworthy by reason of the large number of surgeons in attendance; the high technical quality of the surgical clinics; the important conferences devoted to hospital standardization; the notable character of the cancer symposium; the conference on methods of teaching of surgery; the fracture exhibit and demonstrations; and the conference on industrial medicine and traumatic surgery.

The large and beautifully decorated public rooms of the new Waldorf-Astoria Hotel provided a most attractive setting for Clinical Congress headquarters with unusual facilities for handling so large an attendance.

The surgeons of New York and Brooklyn contributed a clinical program that embraced every phase of surgical endeavor in which all the important hospitals of the metropolis were represented. In addition to an extensive schedule of operative clinics there were numerous clinical demonstrations and symposia contributing greatly to the value of the clinical program. There were numerous demonstrations in roentgenology, surgical pathology, and surgical research in the hospitals, medical schools, and allied institutions. It was found that the visiting surgeons distributed themselves easily among the various hospitals so that the clinics were well attended.

In recognition of the splendid clinical facilities of Brooklyn, Wednesday, October 14, was set aside as "Brooklyn-Long Island Day" so that the clinics in the hospitals of Brooklyn and its suburbs were favored with a larger attendance than at any previous session.

The evening meetings in the ballroom of the new Waldorf-Astoria, where the papers dealt with various phases of general and special surgery, were attended by large audiences filling the ballroom to its capacity each evening. Special meetings of the sections on ophthalmology and otolaryngology of the New York Academy of Medicine, through the courtesy of the officers of those sections, formed a distinct addition to the scientific program.

To provide for a proper contact with the public through the daily newspapers a department of publicity was organized through which all publicity relative to the Congress was handled under the supervision of a press

committee, with the result that at all times the material appearing in the public press was authentic and ethical, and devoted entirely to the scientific aspects of surgery and the ideals and activities of the College.

Of great importance was the extensive utilization of radio broadcasting. All the large local stations, many with national hook-ups, were utilized two or three times daily for the dissemination of useful and timely public instruction. A few of the titles of these five-minute radio broadcasts will indicate their general scope and importance: "The American College of Surgeons, Scientific Medicine and the Public"; "Your Personal Responsibility for Health"; "Cancer and Pain"; "Reducing Cancer Mortality"; "Choosing Your Hospital"; "The Hospital and the Community"; "What Cancers Can be Cured"; "Dividends of Medical Science"; "Conservation of Life and Limb Following Industrial Injuries"; "Adding Years to Your Life."

The evening scientific meetings of the Congress measured up to the high order of previous congresses, the papers being of outstanding importance by reason of the high scientific attainments of the authors and the teaching value represented in their subjects. At the Presidential Meeting on Monday evening, following addresses of welcome by Drs. Charles Gordon Heyd and John E. Jennings, the distinguished foreign guests were introduced. The retiring president, Dr. C. Jeff Miller, of New Orleans, gave a memorable address on "Medical Men and Their Lay Critics." This was followed by the inaugural address of Dr. Allen B. Kanavel, of Chicago, on "Fundamentalism and Social Progress in Medicine." The John B. Murphy oration in surgery by Mr. Arthur H. Burgess, professor of clinical surgery in Victoria University, Manchester, England, on "Murphy, and Some Principles of Urinary Surgery" was in keeping with the splendid traditions of the College and presented Murphy as a signal and outstanding contributor to the development of urological surgery.

A wide range of surgical subjects was covered by the programs for the scientific sessions on Tuesday, Wednesday, and Thursday evenings, and a mere citation of the titles and their authors indicates their high quality: "The Present Status of Cardiac Surgery," Elliott C. Cutler, Cleveland; "The Operative Approach to the Heart and Pericardium," Arthur M. Shipley, Baltimore; "Technique and End-Results in Denervation of the Adrenal Glands," George W. Crile, Cleveland; "The Newer Concept of Chronic Arthritis," Ralph Pemberton, Philadelphia; "A New Method of Operating for the Repair of Ruptured Cruciate Ligaments of the Knee Joint," William R. Cubbins, Chicago; "Some Old Truths about Fractures," William Darrach, New York; "Peritoneal Adhesions: Their Prevention by the Use of Digestive Ferments," Alton Ochsner New Orleans; "Further Experiences with Fascial Repair of Hernia," W. Edward Gallie, Toronto; "Curability of Cancer of the Stomach," Donald C. Balfour, Rochester, Minn.; "Some Experiences in the Treatment of Carcinoma of the Rectum with Radium," Sir Charles Gordon-Watson, London, England.

The special meetings at the Academy of Medicine on Tuesday and Wednesday evenings, devoted to the discussion of subjects of interest to those surgeons who practice in the special fields of ophthalmology and otolaryngology, were attended by large audiences and contributed greatly to the scientific excellence of the program. The speakers and their subjects were as follows: "An Outline of the Activities of the Otological Research Laboratory of the Johns Hopkins University During

the Past Five years," Samuel J. Crowe, Baltimore; "Some Intimate Studies of Nasal Function; Their Bearing upon Diagnosis and Treatment," Arthur W. Proetz, St. Louis; "Clinical Phases of Industrial Injuries of the Eye and Orbit," Edward B. Heckel, Pittsburgh; George H. Cross, Chester, Pa.; E. S. Sherman, Newark; and Henry S. Miles, Bridgeport, Conn.; "Pathological Specimens," Bernard Samuel, New York; "Workmen's Compensation Problems of Interest to Ophthalmologists," V. A. Zimmer, director, Division of Workmen's Compensation, New York State Department of Labor; "The Prevention of Industrial Accidents to the Eye and Orbit," Louis H. Carris, director of the Society of the Prevention of Blindness, New York.

At the nineteenth Convocation of the American College of Surgeons on Friday evening, October 16, honorary fellowships were conferred upon three distinguished European surgeons, and 642 candidates of the Class of 1931 were admitted to Fellowship in the College. With conciseness and clarity of diction, the President, Dr. Allen B. Kanavel, taking for his theme "The Program of the College and the Initiates' Responsibility" placed before the candidates their responsibilities upon becoming Fellows of the College and appealed to them to uphold a standard of professional conduct in keeping with the high resolution of the College. The Fellowship address by Dr. James R. Angell, president of Yale University, "Medicine and the Contemporary Social Order," reviewed the contacts of medicine with the present social order. The masterly arrangement of facts based on service to the community was presented with a broad underlying humanitarianism.

A community health meeting in the Academy of Music in Brooklyn on the evening of Wednesday, October 14, proved a constructive innovation, attracting probably the largest attendance that has ever attended any medical meeting in Greater New York. Dr. John E. Jennings, chairman of the Brooklyn Committee on Arrangements, presided. The speakers were: Franklin H. Martin, Chicago; Allen B. Kanavel, Chicago; Malcolm T. MacEachern, Chicago; Joseph C. Bloodgood, Baltimore; Frederic A. Besley, Waukegan, Illinois; George W. Crile, Cleveland; C. Jeff Miller, New Orleans; Charles H. Mayo, Rochester; and Robert Jolly, Houston.

Certain features of the twenty-first Clinical Congress seem to be worthy of special emphasis: There was manifest throughout the Congress a larger public interest in medicine and surgery. The publicity at all times was informative and instructive, and, with the aid of national and international press associations, the message of the College was given a wide geographical distribution. The radio broadcasting, with the happy selection of subjects and the distinguished character of the speakers, served further to extend the influence of the College in a manner quite remarkable.

To the Fellows of the College, both old and new, there came a marked personal appreciation of their duty to the community and a proper appraisal of their personal responsibility to the high art and the splendid altruism of their profession. Even to the casual observer it was apparent that from the time of the first Congress in New York City in 1912, the College has grown in stature and in prestige. This twenty-first annual Congress, the fourth in New York, served further to accentuate the warm place the College occupies in the hearts and thoughts of the profession in the greater city of New York.

CHARLES GORDON HEYD.

PRESIDENTIAL MEETING, CONVOCATION

ADDRESS OF WELCOME—NEW YORK[1]

CHARLES GORDON HEYD, M.D., F.A.C.S., New York

ON behalf of the medical profession of the City of New York I am happy to bid you welcome and sincerely hope that your visit will be profitable, educative, and pleasant.

In the 7 years since the last Congress met in this city, we have all observed the remarkable change that has taken place in medical education, medical sociology, and in the practice of medicine, *per se*. The forces that have operated upon the practice of medicine have, within the last few years, co-ordinated themselves with the result that there have been erected in this city two medical centers, representing two of the most constructive projects in medical sociology and in medical practice. We have all witnessed the era of mergers in industry and it was not to be doubted but that our medical institutions and hospitals would be affected by this trend of the times and merge with their affiliates. The result is that today in our city we have the Medical Center of Columbia University and the Cornell-New York Hospital Medical Center. Both of these gigantic projects are the resultant of many lines of force and their object has been to create what their names imply, namely, a center for the treatment of disease, for alleviation of human suffering, for research, for medical progress and for the training of young men to become adequate, competent physicians and surgeons.

We invite you to witness what the profession of New York has to offer in the daily run of its activity. By far the larger number of hospitals participating in this Congress are institutions that are dedicated to the teaching of medicine and combine within themselves or their affiliates large teaching facilities. Their work then represents the quality of surgical practice as it may be observed by and large throughout the entire city.

The attending staffs of the various institutions are engaged in a process of continuous education in the art, science, and practice of surgery. Working in approved hospitals, with proper clinical records, with frequent adequate staff meetings, by periodic mortality and morbidity surveys, together with a comprehensive follow-up system, the surgeons of our hospitals are carrying out successfully, I am sure, the object and aim of the American College of Surgeons as it is represented by its membership throughout this country.

The hospitals participating in the Congress are all on the approved list of hospitals of the American College of Surgeons, and the surgeons participating in the clinics are for the most part members of the College.

On behalf of the Medical Society of the County of New York, and in equal measure for the Medical Societies of Kings, Queens, the Bronx and Richmond, we are happy to have you here as visitors and guests.

We sincerely trust that our efforts will not prove unavailing in indicating to you the material progress that has been made in research, in clinical surgery, in surgical technique, and in the lessening of hospital mortality and morbidity. Everything we have is yours and the measure of our welcome is the zeal with which we look forward to showing you all that is worth while in the domain of clinical surgery.

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12, 1931.

ADDRESS OF WELCOME—BROOKLYN[1]

JOHN E. JENNINGS, M.D., F.A.C.S., BROOKLYN

WE are glad that you have come again to visit our hospitals and our clinics, our colleges and our academies of medicine, and us. We cannot tell you how glad we are to see you, but perhaps I may attempt to report some of the reasons why.

First, of course, we feel that we have made some progress since you were here last. We are anxious to show you our new workshops and obtain your approval, if you think it is deserved. We have made and are making progress in a number of different ways; some of them will be in the same direction as that in which you yourselves are going and some may not be identical nor parallel with your course. Many of you are from new, rapidly growing communities, and you are builders, organizers, and pioneers. Welcome to a city where one must demolish if he intends to build!

We are glad that you have come to urge us, by example, to go visiting ourselves. Many of us are very domestic and seldom wander far from our own door. I think the stay-at-home habit is more firmly ingrained in New York surgery than anywhere else in America. We need constant reminders that behind the mountains there are also men. There are men beyond the East River too and we in Brooklyn hope you will visit us in our own home town. We are not so far away. One day has been especially allotted to us. We shall try to make it easy for you to reach us. I think many of you will find a good deal to interest you. Our Brooklyn is a gigantic conglomerate of small cities and we have problems with which some of you, I am sure, are familiar. We want to present these to you. We want to introduce you to our local chapter—The Brooklyn and Long Island Chapter of the American College of Surgeons—first, in a field of activity as yet unploughed. We shall tell you more about that when you come to visit us.

We want to see you face to face and in our many, not enormous clinics, talk to you and to hear the sound of your voices talking back. Tell us who you are and where you come from. Tell us if we are right. Tell us if we are wrong. We will give you an enormous small-town welcome. We are glad that you have come.

[1]Presented before the Clinical Congress of the American College of Surgeons, New York, October 12, 1931.

COMMUNITY HEALTH MEETING—BROOKLYN

AMONG the successful meetings in the interest of public health, the Brooklyn meeting will rank as one of the best that has been held during the meetings of the American College of Surgeons. Due to the interest aroused by Dr. John E. Jennings and his associates in Brooklyn, the Academy of Music was filled with interested laymen. Various representatives of the College presented short talks on the following subjects:

The American College of Surgeons
Franklin H. Martin, M.D., Chicago
Marvels of Modern Medicine
Allen B. Kanavel, M.D., Chicago
Choosing Your Hospital
Malcolm T. MacEachern, M.D., Chicago
What You Should Know about Cancer
Joseph C. Bloodgood, M.D., Baltimore
Preservation of Health in Industry
Frederic A. Besley, M.D., Waukegan, Ill.
Medicine of the Future
George W. Crile, M.D., Cleveland
Your Personal Responsibility for Health
C. Jeff Miller, M.D., New Orleans
Adding Years to Your Life
Charles H. Mayo, M.D., Rochester, Minn.
The Rôle of the Hospital in Human Salvage
Robert Jolly, Houston, Texas

MEDICAL MEN AND THEIR LAY CRITICS[1]

C. JEFF MILLER, M.D., F.A.C.S., NEW ORLEANS

THERE is a sixteenth century version of an old Latin epigram which has to do with the three different aspects a physician can present under three different sets of circumstances:

> "Three faces the Physition hath:
> First as an Angell he
> When he is sought; next when he helps,
> A God he seems to be;
> And last of all, when he hath made
> The sicke, diseased, well
> And asks his guerdon, then he seems
> An oughly Fiend of Hell."

Those same circumstances still prevail, gentlemen of the American College of Surgeons, and in the last aspect we are still all too well known, but the articles that have been appearing about us recently in the lay journals can be interpreted only as meaning that our angelic and our godlike qualities are no longer very apparent. In these days criticism that is usually highly unfavorable and abuse that is frequently close to scurrilous are part of our daily bread. I know, as Kipling puts it, that "doctors always have been and always will be exposed to the contempt of the gifted amateur, the gentleman who knows by intuition everything that it has taken them years to learn," but that does not explain everything. It does not explain the presence of these articles in magazines whose standards, one used to believe, were rather higher than the publication of half truths and misrepresentations and downright falsehoods. I confess that a rather unworthy suspicion has crossed my mind that it has perhaps been easier for our traducers to gain a hearing than it has been for our defenders. Here and there a physician has raised his voice, not always, I am sorry to say, with very profound wisdom, but lay defenders are notably absent, and I find it rather hard to believe that an occasional satisfied layman, an occasional grateful patient, has not tried to say something in our favor.

I cannot help wondering, as I ponder on these articles, whether medical service has really declined to as low a level as the writers would have us believe, or whether the explanation is that the age demands a victim and the medical profession has always been fair game. A good many of the charges, of course, we richly deserve. More than other men, perhaps, we have left undone the things that we ought to have done and done the things that we ought not to have done, but surely we cannot all of us be so steeped in ignorance and incompetence, so far gone in iniquity and avarice, as these all-knowing ladies and gentlemen would have us believe. The old fault of generalizing from insufficient evidence, of making deductions from a single instance, not to mention speaking dogmatically on subjects about which one knows exactly nothing, are everywhere glaringly apparent. What they say is all of it true about some of us, and some of it true about all of us, but that all of it could possibly be true about all of us is a preposterous assumption. I get the impression, as I read, that most of the writers were in the state of mind of the Roman Chesterton describes, who made his living, if I recollect aright, by flinging Christians to the lions; he did not feel it necessary to know very much about the religion they professed, for, as soon as he heard of it, he hated it. They likewise seem to me to resemble a certain Scotchman of whom I once read, William Douglas by name, who was "always positive and sometimes accurate."

As a matter of fact, what are the credentials of these self-appointed critics? What do they really know of the men they are maligning? What do they really know of the responsibilities and heartaches of the profession they damn so blithely? Not very much, I would say. Mr. T. Swann Harding, the most vociferous of them all, may serve as an example. He is described by himself as "chemist and author" and by his publishers as "one of the few lay contributors to orthodox medical journals." I would that his publishers had been more specific. I find him in many lay journals, I find him in a book of nearly 400 pages, in which our sins of omission and commission are handled in minute detail and many words, but I find him not in the medical journals which I and my friends peruse. His objections to us and our ways are perfectly typical of many of our critics.

Mr. Harding does not like it at all because we persist in believing that cancer is not inherited, whereas, he says, the bulk of scientific research proves that it is. He is opposed to the "ill-advised" procedure of thyroidectomy for the relief of exophthalmic goiter. No information, he says, can be expected from examination of the skin and eyes of a subject with "patient anæmia,"

[1]Address of the Retiring President, presented before the Clinical Congress of Surgeons, New York, October 12–16, 1931.

a disease about which I admit he knows more than I do, for I never heard of it. Some doctor, via the *Baltimore Sun*, sees no point to reliance upon the pulse rate in illness, and neither does Mr. Harding. The treatment of the symptoms of the menopause with luminal or anything else is mere witchcraft, for the menopause exhibits no symptoms. He prefers, from the mountain of his obstetric experience, pituitrin to ergot in the treatment of postpartum hæmorrhage, though in severe bleeding, he remarks categorically, "recourse must always be finally had to massage of the uterus to accelerate its contractions." He is opposed to the custom, which he apparently believes routine, of letting nurses direct treatment, though he adds that doctors are so unaccustomed to therapeutics that their endeavors to assume charge themselves practically always end in failure. In short, Mr. T. Swann Harding furnishes an excellent illustration of the dangerous effects of a little knowledge.

One F. C. Kelly, writing in the *Current History Magazine*, punctures any pride we might possibly have in the achievements of modern medicine. According to him, physicians have had nothing to do with the control of disease, the decline in the death rate, and the increased longevity of mankind, all of which things would have happened without them, though how or why is not quite clear. Typhoid inoculation, far from aiding in the control of the disease, stirs up tuberculosis and heart trouble. Vaccination plays no part in the decreasing incidence of smallpox, and the results in diphtheria are just as good without antitoxin as with it. Statistics are plainly beneath this writer's consideration. The use of the X-ray results in sterility and deformed offspring, and anæsthesia is not an unmixed blessing, because more people are lured into surgery with it, to the profit of the surgeon and their own ultimate undoing, than would be the case without it. Mr. Kelly does not care for surgery, most of which he considers entirely unnecessary, and he is at his eloquent best in discussing it. He has it on the word of Frank B. Gilbreth, "an authority on human motions," that the surgeon is the least skilled of any class of handworkers. The proof of this devastating blast seems to lie in the fact that no two surgeons tie sutures just alike, and since only one way can be correct, all the others are naturally wrong. Specialism he heartily condemns, on the ground that a physician incapable of discovering for himself what is the matter with a patient is obviously incapable of assessing the findings of others, a point of view which demands an omniscience scarcely to be hoped for in this very imperfect world. We are not, however, left entirely comfortless; all disease, we are told, is benefited by not thinking about it, and leprosy is named as a particularly good example of this nihilistic treatment. F. C. Kelly illustrates excellently the type of mind which falls with avidity upon the now pointless witticism of Oliver Wendell Holmes, that if the whole materia medica were sunk to the bottom of the sea it would be all the better for mankind and all the worse for the fishes, for to him the practice of medicine means simply the giving of pills.

Bernard Shaw would scorn to be considered among lay journalists, but the preface to *The Doctor's Dilemma* is such an excellent example of the abuse of medical men that we may well include it here. His whole thesis, as Leary says, is based on the premise that whatever is, is wrong, and in medicine, one gathers, things are very wrong indeed. We learn from him that the tragedy of illness at present is that it gives one helplessly into the hands of a profession one so deeply mistrusts. Most doctors have no honor and no conscience, and the truth about them is too terrible to be faced. Surgery is performed and drugs are given only for the sake of fees. Vaccination is done in filth, and vivisection because of a lust for cruelty. The proportion of deaths under the Pasteur treatment of hydrophobia is rather higher than without it—statistics are nothing to G. B. S. All bacteriology is superstition, and methods to prevent infection are simply plays upon human credulity. A difference of medical opinion is one more evidence of ignorance and dishonesty. The rank and file of doctors are no more scientific than their tailors—Mr. Harding believes that the few competent medical men who do exist are to be found in the laboratories and at the heads of departments, leaving the healing of the laity to the mental proletariat of the profession. Every death is to be regarded as a possible and under the present system as a probable murder, and the distinction between a quack doctor and an authorized one is mainly that the latter is legally entitled to sign the death certificates for which both have equal need. But here also is a gleam of hope: in state medicine, of which more later, and in homeopathy, the opsonin theory, and Swedish massage is medical salvation to be found.

Time does not permit the detailed mention of many other equally meretricious critics, but I cannot refrain from calling to your attention Chester T. Crowell, who had, surely, the most unfortunate and most unbelievable series of experiences in hospital that ever befell mortal man.

One other charge of T. Swann Harding's must not be omitted. Dear to his soul, running like a leit motif through all his writing, is the outcome of certain intelligence tests in the army which proved physicians to rank in mentality only just above dentists and veterinarians; for him that places us mentally once and for all, but those of us who emerge from the Binet-Simon test with a mental age of ten or thereabouts have a fellow-feeling for the military doctors who achieved the same results.

In short, there are a host of writers who have their quarrels with us and our performance, many of them richly deserved I admit, but who forget fairness and justice and even good breeding when they undertake to publish them to the world. Levity aside, there is no doubt that many of us richly deserve to be charged, even by such *ex cathedra* critics as these, with ignorance and incompetence. With most of us, however, the charges are relative. Most of us, honestly and without reserve, treat our patients to the best of our ability and knowledge, though ability and knowledge are necessarily variable qualities. We are human beings, exactly like the people who criticize us. We have in our ranks no supermen, no archangels, from whom perfection can be demanded. Conscienceless, unscrupulous men are just as likely to be physicians as to be blacksmiths or priests. Physicians are just as likely to make mistakes as other people, rather more likely, in fact, because medicine is not an exact science and medical art is chiefly learned in the hard school of experience. You and I know, even if the public does not, that symptoms have a disconcerting way of refusing to group themselves into categories, that physical findings have an equally disconcerting way of refusing to be classified, that the same disease appears in protean manifestations, that a diagnosis made with all the skill and ingenuity in the world may prove to be entirely wrong. Finney is quite correct when he says that mistakes due to lack of training and experience differ from the mistakes that are common to us all as human beings and that can no more be avoided in medicine than they can be avoided anywhere else in life.

The public, however, does not seek to classify physicians according to any standard of ability and training. More than that, it shuts its collective ear tightly to any endeavor, public or private, to present the true facts. It reserves to itself vehemently and emphatically the right to choose its own physicians. "Any man"—I quote Finney again—"with an M. D. degree is legally entitled to operate on any person foolish enough or ignorant enough to permit him to do so," and the number of the foolish and ignorant is legion. It is disheartening to realize that intelligent people do not choose their medical attendants with the degree of care they would devote to the purchase of a piece of furniture or a new hat. The public will not learn, it does not care to learn, what are the standards of medical competence. Over the radio, through the public press, in the schools, by every means of publicity which this enlightened age possesses, this organization, like many others, is attempting to tell the laity something of the standards which it should demand of its medical attendants, but our words fall on barren soil. For my own part, when I contemplate the reasoning by which people choose their doctors, I feel like saying what William III said to the crowd he was touching for the King's Evil, "May God give you better health and more sense."

The charge that people do not select the best doctors is, as you know, always answered by the counter-charge that the rank and file of them cannot afford the best doctors. Now I question that very seriously. Of course, the patient who is very poor frequently gets the best for nothing, and the patient who is very rich can pay for the best, though it by no means always follows that he selects the best, for the reason that his mental processes often seem to undergo a species of paralysis when it comes to the judicious selection and choice of medical attendants. The middle classes, the salaried groups, I admit are often hard put to make their medical ends meet, but the chief trouble, I contend, is with hospital expenses, not physicians' fees, and the two problems ought to be argued separately.

For the fees of the best physicians are frequently not only no higher than those of the mediocre ones, they are often decidedly less, both in actual cash and in the time and money saved by shorter hospitalization. I have no doubt that the enormous fees one reads of are charged and obtained in some practices, but most of us know of them only through rumor, most of us have rather flat purses. Moreover, as Glenn Frank points out, the problem of medical expense lies below the thousand dollar line, not above it. The patients who are charged large fees are usually the patients who could afford to pay even larger ones. Only exceptionally is the physician encountered who is not willing to cut his coat to fit his cloth, who is not willing to take into consideration in setting the price of his services the circumstances of the patient and the necessary—please note the word—the necessary hospital expenses. The loudest laments, in my

experience, come from the patients whose hospital expenditures know no restraint and are frequently entirely uncalled for, but who, once discharged, either ignore the physician's bill altogether, or who assure him that they cannot pay it now—if ever—because of those same hospital fees, in comparison to which, I might add, his charge is usually very small.

But the critics think otherwise. They know that all fees are high, and the mere thought of an attempt to collect them throws them into true apoplectic rages. But why is it sinful for a doctor to earn his living by the practice of medicine? Why should he not try to collect his bills? Is there another branch of human endeavor in which the necessity for living by the labor of one's hands and brain is met with so much contumely and scorn? The average physician did not choose his calling primarily because he expected to become rich at it. His cakes and ale are always late in coming and sometimes never arrive at all. Surely he is entitled to some reward for the time and money he has expended in his training, for the toil and effort he puts into his practice.

To attain the degree of ignorance and incompetence with which we are all so glibly charged, it takes the doctor, after his primary education, from seven to nine years of college and hospital work, and it costs him from eight to twelve thousand dollars. When he begins to practise, in addition to maintaining a certain standard of living, he must spend from 30 to 40 per cent of his income for professional equipment and for keeping himself abreast of the medical times. He works hours that a union laborer could not be persuaded to consider for any wage, and food and sleep are frequently very incidental considerations. He does each year hundreds and sometimes thousands of dollars of free work, and he is expected to contribute, besides, to all charitable causes. He comes into his earning days late, and he must stop relatively early because of his physical limitations. He carries responsibilities heavier than those of other men, and Rabelais' jest is still true, "There be more drunkards among us than old physicians." His income continues only while he himself is earning it, and he is very lucky if he collects as much as 60 per cent of his fees. Is there any other profession or business on earth which would continue to operate under such handicaps? Yet contumely and scorn are the lot of the physician who points out to his debtors the necessity he and his family labor under for food and shelter and clothing. The general idea is that his rewards should be purely spiritual, and that he and his subsist on heavenly manna.

I say in all seriousness that I believe the moral sense of the public is steadily diminishing when it comes to doctors' bills. Persons who are honest, one assumes, in other walks of life regard a bill from a physician as something to be paid when they get around to it if it is ever paid at all. If the grocer's bill is not paid, they get no groceries. If the gas bill or the water bill is not paid, a callous corporation or a soulless city council cuts off the gas or water. If the installments on the radio and the automobile and the furniture are not paid, back go the radio and the automobile and the furniture to the firms that sold them. But the physician cannot take back his services, and the ethics of his calling do not permit him to refuse to treat people who do not pay him and who, he knows full well, never intend to pay him.

Some day the doctors may take the public into their confidence on the subject of those same unpaid bills, and I predict that a number of people are going to be very much surprised. For an amazing proportion of them belong to patients who seemingly can provide themselves with all the necessities of life, as well as with most of its luxuries. They have country and city homes, cars and servants. They travel, they send their children to exclusive schools, they entertain lavishly. But they do not pay their doctors, and they meet them publicly and socially with never a quiver. I myself have frequently lunched and dined in the company of people who had owed me money for months and years, but I myself was the only person present who was at all embarrassed.

To leave this engrossing consideration, it has often struck me as very curious that our critics do not seem able to interpret our own criticisms of ourselves. They quote what we say of ourselves as direct evidence of their blanket contention of our worthlessness, without comprehending the healthy significance of our own realization of our own shortcomings. For instance, last year in this very Congress I had something to say concerning incompetent surgery, and I find a portion of my remarks used to advertise T. Swann Harding's book, on the blurb of which I travel in the distinguished company of Dr. W. J. Mayo. The average lay journalist complacently assumes, since we admit that we have faults, that everything in medicine must be wrong and every medical man must be a scoundrel. It does not seem to dawn upon them that we are merely cleaning our own house, that the indictment is of the few, not of the many, and that it is most right and proper that it should come from within.

Another thing: I have long contended that one of the most helpful things that any staff can do is

to study its output, and, in particular, to analyze its mortality, and that the individual surgeon would do well to evaluate his personal work in the same exact manner. A striking case in point—and here, as I have done elsewhere, I pay tribute to the gallant courage which inspired it—was the fearless publication by Watson and his staff of the details of that nightmare epidemic of puerperal infection which scourged the Sloane Maternity a few years ago. Medicine is benefited and bettered by the unafraid facing of its own performance, yet one cannot refrain from wondering what the critics of the profession would make of such reports, and speculating on the mud-slinging that would undoubtedly ensue.

A woman journalist with a vitriolic pen, in a recent discussion of fee splitting, is apparently quite unaware of the compliment she pays us when she remarks that in the larger hospitals of a certain city, in which the staff is composed mainly of Fellows of the American College of Surgeons, such an abuse is not prevalent, whereas it is rife in smaller hospitals, on whose staffs are few Fellows of the College. Her intention, obviously, is not complimentary, but her remark works both ways: it is as much a tribute to the achievements of the College as it is an indictment of the Fellows who do not live up to its requirements. It would be a unique situation, for that matter, if in this special organization, composed of nearly 10,000 members, there were not, in spite of the strictest insistence upon qualifications and character, men who were not worthy, men to whom the Fellowship pledge was merely a scrap of paper. But surely that does not condemn us all.

The remedies suggested we can touch upon only briefly. Advertising obviously would not help, for the incompetent physician would blow his medical horn far more loudly than his better trained confrere, and the public would be slightly more bewildered than it is now. The group clinic, with specialists at the head of every department, with adequate laboratory facilities, and with a reduced overhead because of a businesslike administration, has much to commend it, and the clinics for salaried, middle class patients, as run by Johns Hopkins Hospital and Cornell University, have done a great public service. On the other hand, under this plan the personal relation between physician and patient, which has been, and in the opinion of old fashioned practitioners like myself, still is the bulwark of medical practice, would receive its death blow.

Health insurance works in nearly twenty-five countries, being more or less successful according to the degree of paternalism which the government practises in its administration, but it is doubtful whether it would ever work in the United States, and it is obviously open to grave danger of abuse. Perhaps in the future some practical scheme of private insurance can be worked out. If it can, it will be a better thing than the voluntary saving against a medical rainy day which is the only recourse at present, and which stands small chance against the counter-claims of installment salesmen.

The most ardent reformers of medicine, however, pay small heed to such schemes as these. It is upon the project of state medicine that they fall with the loudest cries of joy. The profession, Shaw assures the world, will remain a gigantic conspiracy to exploit human credulity and suffering until it becomes a body of men trained and paid by the country to keep it in health. Harding, apparently forgetting the scandalous showing of the army doctors in the matter of the intelligence quotient, quotes the army and navy to prove how speedily such a scheme would usher in the medical utopia. Even Glenn Frank, whose brilliant address before the Congress two years ago is still fresh in our minds, seems to have a childlike faith that when medicine is under state control, disease will be conquered and death will be no more.

Perhaps so, but I doubt it. Why should the practice of medicine by the state herald the millennial dawn? What has happened in Russia does not fill with enthusiasm those who have seen conditions at first hand. The coroners and health officers at present in charge of our affairs are often not of a caliber to inspire us with much hope for the future. Public and municipal hospitals are filled with medico-political appointees whose ability is frequently negligible and whose ethics are frequently doubtful. One has only to look at the corruption in state and municipal governments throughout the country today to question very seriously the claims which are made for further state control of anything. The old query forces itself to the fore, what price politics?

It is consoling to know that all of our lay critics do not believe that we are headed straight for perdition. The cynical Theodore Dreiser, for instance, paints a very tender picture of a type of doctor who still, thank heaven, exists among us. W. D. Howells says that doctors are almost universally gentlemen, either because they were born so or because the Hippocratic oath has made them so, and he writes with sympathy and understanding of the failures and disappointments of the physician, who knows more evil than other men, yet who still is merciful to human frailty and who gives to mankind more even than the priest.

Stevenson's tribute to the physician as the "fine flower of our civilization," is too well known to need repetition, and St. Loe Strachey echoes him when he says that there is no profession which is more exposed to the temptation to forget honor, humanity, and kindness, none in which the exploitation of human suffering is easier, and yet none in which the temptation is so triumphantly withstood.

I do not think that we altogether deserve the cheap abuse, the verbose smartness, that is leveled at us so often in the lay press today. On the other hand, we would do well to remember, as Kipling says, that no shortcomings on the part of others can save us from our own. We deserve all too many of the charges that are brought against us. We know far too much science, Harding and his fellows to the contrary, and far too little of the medical art. We have too much knowledge and too little humanity. We fumble and stray when we should walk direct and straight. We fail all too often, though it would be simple justice for our critics to remember that inability to cure is not necessarily a stigma of ignorance and incompetence. We are an altruistic and a self-destroying profession, yet we are too frequently selfish and self-seeking. But we carry, the poorest of us, a heavy load of care and responsibility and constantly recurring disappointment which those who have not borne it cannot possibly comprehend.

Strachey, in that same essay from which I have just quoted, mentions a life of Hippocrates, written by an American physician and dedicated "To the noble profession whose gospel is the healing of mankind, whose honor is the Hippocratic Oath." That is our ideal, Gentlemen of the College, even though we fail to achieve it, and as I resign these symbols of the office with which you have honored me to the President who is to succeed me, I am giving them, as you and I know, to an honorable gentleman and distinguished surgeon who exemplifies in his life and practice this high ideal, and in whose hands the destinies of this College are safe.

NOTE.—I desire to express my appreciation of the work of my secretary, Elizabeth M. McFetridge, M.A., who is responsible for the collection of the references used in this paper and for a considerable part of its preparation.

Allen B. Manaree

FUNDAMENTALISM AND SOCIAL PROGRESS IN MEDICINE[1]

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THE investiture with these robes of honor brings with it a sense of humility, especially when one remembers the distinguished surgeons who have preceded him. They are accepted, however, as an expression of your desire that each and every member of the College should feel that the duties and responsibilities of membership should be shared by all, that our College is democratic not autocratic, an association not a government, the concrete expression of the ideal that the most enduring progress in social movements follows the participation of all, even the humblest, in its deliberations and activities.

In this spirit of mutual counsel, may I bring for your consideration some of the problems of the present day tendency toward the socialization of medicine with its suggestions for group and contract practice and modification of our code of ethics? In beginning the consideration, it is pertinent to ask whether we have minds sufficiently free from guild arrogance, guild complacency, and guild fundamentalism to consider wisely the basic principles. The history of medicine is replete with examples of our ultra-conservatism. In Egypt medical practice was rigidly prescribed by the Hermetic Books of Thoth and, if a patient's death followed any variation from the prescribed procedure, it was regarded as a capital crime. Aristotle in his *Politics* says that physicians were allowed to depart from the accepted methods of treatment only in case the patient did not improve in four days. The authority of Galen benumbed scientific medicine for thirteen centuries. The only question was whether the original Latin translations or that of the Mohammedan, Avicenna, interpreted the master correctly. It was not until Paracelsus came to the bonfire of the students at Basel celebrating the Feast of St. John and threw into the blazing flames his Avicenna's *Canon of Medicine*, saying: "Into St. John's Fire so that all misfortune may go into the air with the smoke" that the pall of Galenic authority was lifted. So Luther broke the spell of the papacy when he burned the papal Bull and Statutes by the Elster Gate of Wittemberg.

There is some justification for fundamentalism in social concepts, but none in science. This the Catholic Church found when it denied that the planets moved around the sun; and the faculty of Basel when it called Paracelsus "a liar," "a suborner," "a necromancer," "possessed of the devil," "an ox head," and "the forest ass of Einsiedeln." Neither the imprisonment of Galileo by the Inquisition nor the banishment of Paracelsus changed the facts in the slightest degree.

Guild arrogance refused for fifteen centuries to recognize medical thought unless expressed in Latin and emanating from established centers of learning. Literature was proud to honor the English language with its Chaucer and Shakespeare, Italian with its Dante and Tasso, French with its Deschamps and Villon, but medicine clung to its Latin. Dr. Lorenz Fries, although of the Galenic school, was persecuted because he said, "Methinks German is not less worthy to express all things than are Greek, Hebrew, and Latin." The barber surgeons of France were denied professional rights because they could not read and write Latin, and even today physicians look somewhat askance at those who do not write their prescriptions in that language.

Are we yet free from the guild arrogance that refused to recognize Paré, John of Arderne, and Seigneur de Stains as reputable members of the profession? Yet Paré made Paris the surgical center of the world, John, of Arderne, established surgical practice in England and maintained untarnished its ethical standards, while Seigneur de Stains, "booted lackey" as described by the physicians, ennobled by Louis XIV for curing him of a fistula-in-ano when the physicians had failed, helped to elevate French surgeons to an enviable social position. The untrammeled and unprejudiced mind is essential to scientific progress. Bacon says, "Truth is the daughter of time and not of authority." Bunyan's shepherd guides, Knowledge, Experience, Watchful, and Sincere, are for medicine much better guides than Authority, Guild Arrogance, and Self Complacency. "Medicine learned from a monk how to use antimony, from a Jesuit how to cure ague, from a friar how to cut for stone, from a postmaster how to sound the Eustachian tube, and from a dairy maid how to prevent smallpox." (Holmes.) Are we now equally ready to accept and utilize new ideas whether they come from old or new centers of medical thought; whether from well known or obscure surgeons and, indeed, from within or without our profession? It was difficult for continental surgeons to believe that far removed from the wards of Velpeau, Simpson, and Semmelweis, Sims had established successful procedures for the

[1]Inaugural Address presented before the Clinical Congress of the American College of Surgeons, New York, October 12–16, 1931.

cure of vaginal fistula, Mott had ligated the innominate artery, and a backwoods surgeon of Kentucky had removed ovarian cysts. I am not certain but that at the present time there is still some lingering thought that the Alleghenys or the Mississippi river is the natural scientific border of the United States. If we are to exercise good judgment and initiate constructive action in the consideration of modern social tendencies in medicine, we must avoid all the artificial limitations of guild fundamentalism.

Of late there has been an insistent demand for a greater socialization of medicine with some modification of our code of ethics and attitude toward publicity, contract practice, part-pay clinics, and group associations formed to give medical attention at a minimum cost. Some say that medicine as now practiced is ready for the museum of social institutions.

In contrast to this it is urged that those who emphasize the defects of modern practice are blind to the defects of socialized medicine with its benumbing of that initiative which produced our Pasteurs, Kochs, and Hunters, our Oslers, Mayos, and McDowells; with its deterioration of the personal into impersonal relationship; with its sterility in human sympathy that shrivels the generous instincts of society and makes out of medicine a soulless machine. It is said that our age is already too mechanistic and, if we continue, we shall replace beauty, love, generosity, and all the attributes of individuality with a hard, cold, and aspirationless mechanistic society concerned only with the privilege of being born, the duty of living, and the inevitability of dying.

Conscious of our own pure ideals, knowing our constant improvement in the application of knowledge to the cure and eradication of disease, and filled with pride at our discoveries and the advance in medical science, we are surprised that an enlightened public dares to question our methods of practice and we unwisely resent any attempt to change them. The day of such comfortable thoughts is over. The swirling unrest of modern society has caught us unprepared to meet its demands. Judgment is asked to function where the conditions for it are least favorable. The educated man sees the possible pitfalls of any change —he wishes to stop, look, and listen, to accept change only after careful and after troubled consideration, but the tempo of modern society demands quick decisions whether right or wrong. Thus we find ourselves, instead of guiding the changing conception of medical service, dragged at the chariot wheels of reckless, ill informed doctrinaires and social reformers.

One cannot help but hope that from these two conflicting views will come some constructive thoughts that will meet the exigencies of modern life and yet retain the ideals of medicine, the personal relationship of physicians with the unfortunate sick, and permit the unhampered progress of medical science. This is one of the great problems to be met by the American College of Surgeons, and it must be met by you younger members of our organization. In affiliating yourselves with us, you have accepted our responsibilities as well as our privileges, and to you particularly will fall the solution of this question in the years that are to follow. You will fail if you do not avoid blind attachment to old principles, unthinking veneration for tradition, and do not recognize the fluidity and provisional nature of medicine in its relation to society. Such change will come probably not as a perfected plan of procedure, but as "an hypothesis in action modified by the experience it adduces." Guild isolation must cease. We must not, like the Pharisees, set ourselves apart with broad phylacteries upon our brows. A knowledge of the attainments of modern scientific medicine must not be the peculiar birthright of the physician, but must become a part of the common heritage of the every day citizen. Far from resenting the inquiry of the public as to our aims and ideals, we must welcome the association of the constructive mind of the well informed laymen in the solution of the great problems of the application of our discoveries to the benefit of mankind. Our medical schools must be training centers for public service, our actions must be based not on the trade union concept of preserving our rights and maintaining our guild superiority, but upon the premise that when we serve the public disinterestedly we serve ourselves best.

Twenty centuries have established certain principles of professional conduct and medical practice and we have embodied these principles in a code of ethics. But is this legal expression of moral and ethical conduct sacrosanct? Ethics and morals do not change, but our interpretation of them as applied to social conditions must vary with changing conditions. Into our social structure have come many startling changes during the last decade, and it is pertinent to ask whether some modification of our concepts of ethical practice may not be necessary to meet these changed conditions. The public resents decisions as to professional conduct made upon technical interpretation of our code and has rightly demanded action based upon the broad principle of public welfare. How far may education of the public go as to the standards and service of institutions

or physicians connected with them, and not become unethical advertising? Is contract practice in itself reprehensible or is it the manner in which the practice is carried on the evil we wish to correct? Is the part-pay clinic wrong or is it the abuse of its facilities that is inimical to public welfare? The time has passed, if it were ever here, when we can decide these questions on the grounds of guild welfare. The interest of the community and the patient must be our first consideration. I am not unaware of the great dangers that threaten with any modification of our ethical laws. Unlicensed publicity opens the door for unjustified personal exploitation, for the advertising of institutions in which the returns secured depend upon the pernicious power of an unlicensed and unbridled press, and it destroys the ancient safeguard of the patient, that worth and works of the competent physician offer the safest recommendation.

On the other hand, when we see the exploitation of the poorly informed public by charlatans and medical hijackers, we must meet with constructive suggestions the desire of ethical institutions and public spirited organizations to eradicate this evil, must realize the distinction between advertising for personal and selfish ends and that for the education and welfare of our people, must acknowledge that the principle of protection of the public for which our code was established may be better served by some change in our conception of the application of our rules.

Contract practice is probably the most important question confronting us today. We recognize that it may substitute impersonal responsibility for personal, destroy individual scientific endeavor, and end in careless, hasty, and machine made service to the patient. But the necessarily high cost of competent medical service, the proved value of the association of able trained specialists, and the necessity for well equipped hospitals and medical centers for the proper study, diagnosis, and treatment of disease present problems not easily solved under our established system of individual service.

Social science and the expanding conception of medical service are leaping ahead of us, somewhat bewildered, hardly knowing what they require, earnestly anxious for help. If we do not help to solve the questions of competent, reasonably priced service, ill advised, poorly conceived, and unfortunately executed methods of service will be forced upon us with disastrous results to the public and the profession, and we will find ourselves like King Lear roaring at the storm, bareheaded and helpless.

We must begin our thinking by eradicating from our minds all thought of guild consciousness or personal aggrandizement, and ask ourselves how we can bring to all patients competent, reasonably priced service. We cannot deny that part-pay clinics may be advisable in certain instances, that contractual relations with institutions or organizations may at times secure the best service. It is the abuse of these that we must guard against.

It behooves us to give careful consideration to this so called contract practice and not because of the fetish of a name, compel organizations of individuals, industry, and institutions to employ incompetent individuals for service. Neither the individual, industry, nor the constituted authorities of government wish inadequate service; yet through the urge for reasonably priced medical attention this catastrophe is liable to occur unless, with broad and unselfish vision, we help to guide the movement toward collective medical service rather than sit complacently by, bulwarked by a supposedly sacrosanct code of ethics, and let the initiative slip from our hands.

Because of its contact with medical practice in every part of the United States, the American College of Surgeons is particularly equipped to study this question. It touches in an intimate way daily surgical practice in every state, and every form of social and industrial life.

When Pennsylvania, Rhode Island, Tennessee, Vermont, and Alabama pass compensation laws limiting payment to one hundred dollars and Kansas and Kentucky to two hundred dollars for medical and hospital attention to injured employees, we know it ends in incompetent service; but on the other hand, we must not forget that Connecticut, Idaho, Illinois and other states grant reasonable compensation, and that an industry in South Carolina has established a contract service for its employees that has secured commendation alike from physicians and patients. Side by side in Oregon flourish commendable and censurable experiments in industrial medicine.

The College was not born with a caul, so cannot be clairvoyant but must depend upon intensive study of the problem. It should not make its decisions based upon protection of a local group, but upon the sweep of the broad flowing stream of social medical service, and never lose sight of the principle that its actions must be based upon what will ultimately redound to the real service of patients. With our organization we should be able to gather all available data as to state laws regarding compensation, as to all types of contract practice established by industry or organizations, and to evaluate the results of these in terms

of service to the sick. Thus we should be able at least to guide the trend of medical socialization.

Statesmanship consists in having the capacity to evaluate ideas. The doctrinaire with his formula worship, the social reformer with idealized concepts uncrystallized by the fire of experience, and industry with thoughtless materialism, enunciate plans of medical service, and it is the part of physicians who deal with the problem daily to evaluate them, not with prejudice, self-consideration, or guild consciousness, but with unselfish statesmanship.

Guild consciousness on the one hand, and an appreciation of the dangers of communistic medicine on the other, make us hesitate in recommending changes in the practice of medicine. We must not forget, however, that we take pride in the free public school system of our country, that the teachers are devoted and progressive, and no one would dare to question that the general education of our people has been a profitable social experiment. It is equally true, however, that the presence of non-public institutions, endowed by a generous public, working side by side with our public schools, has been an incentive to better work; often indeed, these non-public institutions have initiated advantageous changes and more progressive policies in our methods of teaching.

With this successful example of social service before our eyes in the every day life of our people, we should not be unbending in our opposition to some modification of our system of medical practice that will insure equally to the indigent, the man of moderate means, and the wealthy, competent diagnosis and treatment and yet retain the self respect of all. The physicians in charge of any such public service must receive compensation commensurate with the years of study necessary to the adequate preparation for the practice of medicine. If we judge by our experience with our public school system, with any public service must go private institutions and private practice if we are to maintain the high standards of medicine and insure the continued advance of the frontiers of medical knowledge.

Eighty years ago Virchow said, "Should medicine ever fulfill its great end, it must enter into the larger political and social life of our times." The solution of the problem of the absorption of medical service into the life of our people must come with the combined disinterested study of industry, labor, physicians, and the public, but the initiative should come from the medical profession and particularly its organizations, as the American College of Surgeons, who desire to serve disinterestedly the elevation of medical service.

The economic world today is in the midst of a gigantic social upheaval, the end of which awaits either constructive action or world disorganization. So far there has been more drift than direction. It demands upon those whom intelligence has made leaders more humility and less arrogance, and upon those who are less favored more rationalism and less theory, but the maelstrom of conflicting factors is so vast that one questions whether social engineers can be found able to guide the turbulent stream into orderly progress.

That the medical profession, however, has not been unmindful of its public duty and has not failed to advocate and establish new principles in the professional care and medical education of the public is proved not alone by the free service we have given our hospitals and medical institutions, but by the initiation and support of such movements as infant welfare, medical social service, studies of the care of the insane; by our associations for the prevention of blindness, tuberculosis, and heart disease; by our campaigns to lessen trachoma, venereal disease, and the deleterious effects of age; by our interest in proper housing, prenatal care, instruction of expectant mothers, the education of the public in combating the spread of contagious disease, the yearly health examination, rural medical service, juvenile delinquencies, and the inspection and instruction of school children.

Temporarily capital may provide medical service more adequate than the uninformed laborer can secure, medical protective associations may give service more cheaply, states may establish legal restrictions limiting the spread of disease, or provide institutions and free care for their citizens, but these are only steps in a social development educative of the people as well as the profession. Permanent social movements can go no faster than public education. The doctrinaires and the social reformers have their place, but it is educative and not legislative. The public will not be satisfied with less than personal service in illness, and the profession will, we may be sure, meet the demands of a changing conception of competent medical service within the reach of all.

In the solution of these great problems you as members of the American College of Surgeons must take a prominent part. As your guide may I suggest the following aphorism.

The justification of any medical organization lies in the unselfishness of its ideals, its achievements come from its initiative and freedom from guild fundamentalism, and its permanence rests upon its service to the public.

PRESENTATION OF HONORARY FELLOWS

FRANKLIN H. MARTIN, M.D., F.A.C.S., CHICAGO

AT the Convocation on Friday evening Honorary Fellowships were conferred by the President on the following eminent surgeons:

PROFESSOR DOCTOR HANS VON HABERER, Cologne, Germany; an alumnus of the Medical School, University of Graz; Geheimer Hofrat Professor, Doctor of Medicine; Distinguished Surgeon; Clinical Professor of Surgery, University of Cologne; Director of the Surgical Clinic, University of Cologne. Introduced by Dr. Frederic A. Besley.

PROFESSOR ARTHUR HENRY BURGESS, M.B., F.R.C.S., Manchester, England; Distinguished Graduate and Professor of Clinical Surgery of the University of Manchester; Senior Honorary Surgeon to the Manchester Royal Infirmary; Consulting Surgeon to the Christie Hospital for Cancer, Manchester; Past President of the British Medical Association. Introduced by Dr. George W. Crile.

SIR CHARLES GORDON-WATSON, K.B.E., C.M.G., F.R.C.S., London, England; Eminent Surgeon; Graduate and Joint Lecturer in Surgery, St. Bartholomew's Medical College; Surgeon to St. Bartholomew's and St. Mark's Hospitals; Consulting Surgeon, Metropolitan Hospital; Member of the Council, Royal College of Surgeons of England; Ex-President of the Aesculapian Society. Introduced by Dr. George David Stewart.

PRESENTATION OF CANDIDATES—CLASS OF 1931

FRANKLIN H. MARTIN, M.D., F.A.C.S., CHICAGO

IN behalf of the Board of Regents of the American College of Surgeons, I have the honor to present to you, Mr. President, candidates for Fellowship in the College, as follows:

United States	619
Canada	7
Alaska	1
Hawaii	4
Philippine Islands	1
Australia	1
China	1
England	1
Guatemala	1
India	1
Mexico	2
Panama	1
Siam	2
Total	642

Inasmuch as the candidates before you have fulfilled all of the requirements for admission to Fellowship, and have affirmed the Fellowship Pledge of the American College of Surgeons, on authority of the Board of Regents of the College, I take great pleasure in presenting them for Fellowship.

Each year as we receive a new class of candidates into Fellowship I am impressed by the prestige of an institution that can influence such a goodly number of busy practitioners of surgery to seek its portals.

To the casual observer these men appear as one more group that is being enrolled into our ranks. Complacently, this observer shrugs his shoulders and reflects: "How easy!"

As an illustration let us enumerate the facts: There were 4,388 applications for Fellowship on file January 1, 1931. Seven hundred and nineteen of them were already approved by their state or provincial committees on credentials; 1,490 were presented to state and provincial committees on credentials during this year. Of these, only 640, or 45.5 per cent, were approved and recommended for examination. Of the total recommended for Fellowship before and since January 1, 1931 (1,359), our careful sifting process has admitted to Fellowship only 642, or 47.2 per cent, constituting the candidates who are here present.

Surely if we pay tribute where tribute is due we must pay full portion to the magnificent group which is before us this evening. Veritably they are the survival of the fittest.

They are to be congratulated; and the *College* is to be congratulated; but above all, we must congratulate the people who shall in the future seek their services.

CASE HISTORY—HONOR LIST AND PRIZE AWARD

ALLEN B. KANAVEL, M.D., F.A.C.S., CHICAGO

SURGERY, GYNECOLOGY AND OBSTETRICS—the official journal of the American College of Surgeons—acknowledges a deep obligation to the College. Two of its fundamental activities have materially increased the value of contributions to medical and surgical literature: First, the standardization and amplification of case records in the approved hospitals of the United States and Canada; and, second, the recognition of the College which requires as an evidence of qualification for Fellowship the filing of one hundred case records of operations actually performed by the candidate.

I wish every friend of the College could peruse the sixty-five thousand individual case records filed this year by this group of successful candidates here before us. The judicial and painstaking examination of those sixty-five thousand records by the group of volunteers who are selected from among the teachers of surgery and the specialties in the medical departments of the four universities of Chicago would be an inspiration to any observer. Each year the quality of these records has improved until now, after eighteen years of effort, many of them are veritable volumes of literature of the most acceptable type—mechanically, artistically, and scientifically.

SURGERY, GYNECOLOGY AND OBSTETRICS, in 1930, asked the privilege, and the request was cheerfully granted by the Regents, of presenting an annual prize in the form of a life Fellowship in the American College of Surgeons for the most acceptable set of case records presented by the candidates during the preceding year. The prize consists of Five Hundred Dollars, invested in the name of the successful candidate for life dues in the American College of Surgeons, and is accompanied by an appropriately engraved certificate of appreciation on behalf of the donor, SURGERY, GYNECOLOGY AND OBSTETRICS. The prize winner last year was Dr. James T. Nix, of New Orleans.

The Committee in seeking the prize winner from among the successful candidates before you, selected five outstanding sets of records which constitute an honor list. May I ask each honor man to rise as his name is read?

Charles Teel, of Bellingham, Washington
Dorsey Brannan, of Morgantown, West Virginia
Roger C. Graves, of Boston, Massachusetts
Harold A. Furlong, of Pontiac, Michigan
H. H. Ogilvie, of San Antonio, Texas

And now, may I announce the prize winner from among this group and invite him to the platform to receive the certificate of appreciation from our official journal, and the formal receipt for life dues in the American College of Surgeons.

Will Dr. Ogilvie please come to the platform?

Dr. Ogilvie, this recognition of your work is an expression by the College of its belief that scientific investigation, careful records, and critical analysis of case histories elevates the standard of surgery and insures to patients the most efficient care. It is our hope that this expression of commendation may serve to stimulate others to emulate your example, advance the frontiers of surgical knowledge, and benefit those entrusted to our care. I congratulate you.

THE PROGRAM OF THE COLLEGE AND THE INITIATES' RESPONSIBILITIES[1]

ALLEN B. KANAVEL, M.D., F.A.C.S., CHICAGO

NO more pleasing duty can fall to one than that of officially welcoming into fellowship the initiates of the College. Out of 1,359 applications for fellowship already approved by state and provincial committees, your group of 642 or only 47.2 per cent of the total has been selected as worthy of membership, attesting the care exercised by the authorities of the College in selecting its fellows. Accredited after careful consideration by your state and provincial organizations, chosen after painstaking analysis of your actual results in the practice of surgery, and approved by the Board of Regents only after grave deliberation, you may justly take pride in your induction into fellowship. With it, however, must come a realization of your responsibilities.

Eighteen years have now elapsed since the organization of the College and we may well pause to pay tribute to that distinguished group who inaugurated and has largely directed the policies of the College during its formative years. No one acquainted with American surgery would dare to say that the development and ideals of the College could have been trusted to abler hands when we recall the names of its first ten presidents, Finney, Crile, William Mayo, Armstrong, Deaver, Cushing, Ochsner, Charles Mayo, Matas, and Chipman. These, with Murphy and Martin, have had a large part in the development of the College during its formative years.

Three of these rest in honor, Murphy, Ochsner, and Deaver. Murphy performed the first appendectomy in America, invented the Murphy button for intestinal anastomosis; performed, among the first, suture of blood vessels; and made other highly important contributions to our knowledge of the surgery of the bones, joints, nerves, and lungs. He was ennobled by the Pope for his service to humanity, and decorated by several of the great powers of Europe and Asia for his service to science. Ochsner was one of the first in America to emphasize the value of the microscope to the surgeon and to correlate tuberculous glands of the neck with tonsillar infection. What Paré did for Paris, Billroth for Vienna, Lister for Glasgow, Edinburgh, and London, Ochsner with Murphy and Senn did for Chicago, making it one of the greatest clinical centers of the world.

The American College of Surgeons in honor of Murphy has erected in Chicago a great memorial building to further its activities, and in honor of Ochsner has established a department of clinical research. In the future other marks of our respect and admiration should be associated with the names of our distinguished founders.

You have now been inducted into fellowship with these leaders of our profession. You have been chosen as representing the advanced surgical thought in your various communities. Whatever honor this induction may signify, it imposes greater demands upon you for service. You may well observe the law subscribed to by the surgeons of England over five centuries ago, namely, that no member "of the said craft of surgery" is to "put any man out of his cure[2] otherwise than the honesty[3] of the craft will,[4] but that each of them be ready if need be or by any of the parties called thereto, then honestly[5] to help each other with counsel or deed, that worship, profit, and honesty of the craft and helping of the sick be done on all sides."

Your organization is one devoted to self-criticism and self-improvement. Nowhere will you find that the College has arrogated to itself judgment upon the acts of surgeons or organizations outside of itself. We have, however, dared to say that after careful survey and study we believe certain surgeons and institutions are worthy of public confidence and trust. Any authority we may have has followed from the sincerity and honesty of our purpose and actions. To you has been bequeathed this great heritage of public and professional confidence. You will be watched with jealous eye and the failure of anyone of you to conserve the ideals of professional honor, of service to the public, and of self-improvement will impair more than you realize, the prestige of the College.

By a study of reports available to you through application to headquarters you should acquaint yourselves with the past activities and accomplishments of the College since, in the few moments at my disposal, only the barest outline of the work of our distinguished director general, his associates, and the various committees, can be given. These accomplishments have found expression,

[2]Steal his patient from him.
[3]Honor.
[4]Allows.
[5]Honorably.

[1]Presidential Address presented before the Convocation of the American College of Surgeons, New York, October 12–16, 1931.

first, in the maintenance and elevation of professional ideals, second, in service to the public, and third, in the advancement of surgical science.

Ideals are not intangible when expressed in action, and the American College of Surgeons has demonstrated their applicability to medical service. Division of fees is not a new evil engendered by modern commercialism. In the 12th century the school of Salerno required of the applicant for its license to practice surgery, that "he must swear to be true and obedient to the society, to refuse fees from the poor and to have no share of gains with the apothecaries." That the determined opposition of the College to this evil has elevated the standard of service, conserved our self-respect, and commanded the confidence of the public is no small part of our contribution to surgical practice.

Our insistence that properdiagnosis must precede operation, that competent service outweigh personal consideration, and that restoration of physiological function is essential to good surgery, has elevated the ideals of practice. Our hospital staff conference with its open confession of error and helpful fraternal advice has made the surgeon desire more the commendation and respect of his discriminating fellow surgeons than the approbation of the uninformed public.

Our inter-American activities have served not alone to cement the professional activities of the United States with South America, Canada, Mexico, and its contiguous republics, but also, we dare hope, have fostered the cultural and political associations of the Western Hemisphere.

Our service to the public has found expression in concrete accomplishments.

To meet the need for nursing of the sick the Knights Templers lined the road of the Crusaders to Jerusalem with hospitals, but the suppurating wounds and fever infested wards recorded by history attest that something more than religious enthusiasm is necessary for competent care of the sick. At a later period Dickens' Sairey Gamp caricatures the English nursing home, and all caricature that has lived has had a germ of truth. That hospital service in our own day had not kept pace with the advancement of medical science is attested by the fact that sixteen years ago your College instituted a survey of hospitals and established a minimum standard of service which an institution should attain to be recognized as competent to care for the sick. It is astounding to record that, simple as was this standard, only 89 out of 692 hospitals of one hundred beds and over could meet the requirements. During the ensuing sixteen years at an annual expense of over seventy-five thousand dollars, the College has maintained a department of hospital inspection and assistance. By education of hospital boards, physicians, and the public, the evil has been corrected, and our last report shows that 93 per cent of these same institutions have reached or surpassed the standard. Equal improvement has been secured by similar surveys extended to smaller hospitals. We have educated the public to realize that something more than good intention, religious atmosphere, and bricks and mortar are necessary to care for the sick; that hospitals must be equipped with chemical and X-ray laboratories, with dietary, social service, and other essential departments. We have educated boards of trustees to recognize the necessity for proper equipment and adequate service, to assume a mutual responsibility with the superintendent and medical staff to attain this end, and to take pride in the fact that they are maintaining not a simple nursing home or custodial institution, but a modern hospital and social medical center devoted to competent care of the sick, the elevation of ethical standards, and the advance of medical science. Our studies of the cost of medical care, proper and economical construction of hospitals, simplification and standardization of hospital supplies and equipment have supplemented and aided their campaigns for better institutions.

By our insistance upon proper equipment, ethical service, better records, more careful study of patients, we have supported the medical staffs of the more isolated institutions in their endeavor to bring to their communities the same competent ethical service attained by university hospitals.

Our yearly report of accredited hospitals and public meetings have informed the public as to where competent care can be secured, aroused the pride of communities in their local institutions, stimulated interest in scientific medicine, and educated the people as to the futility of charlatanism, faith healing, and cultism.

Our surveys as to the care of employees in industry, investigations of compensation laws and co-operative medical service, studies of accident insurance, setting up of medical organizations in industry, bid fair to be of material aid in the adjustment of these vexed questions so vital to industry, insurance companies, and, most of all, to the injured.

Important as have been these contributions to public welfare, they are insignificant compared with the achievements in the elevation of surgical service and the application of medical science. It has been our ambition to remove carpentry from

surgery, to make available in every community honest, competent surgical service, to establish university ideals of diagnosis and service in every hospital, and to bring to every surgeon the opportunity for self-improvement. We have endeavored to make every hospital a post-graduate school. Our staff conferences have fostered the group study of results, thus emphasizing the necessity for better preliminary diagnosis, more judicious consideration as to the necessity for operation, more care as to the choice of surgical procedure, and more painstaking attention to those intrusted to our care. These conferences have engendered mutual helpfulness instead of competition, open acknowledgement of failures, and staff study of the means to avoid them. The surgeon is no more an individualist, but an active member of a scientific staff-faculty, assuming with others a mutual responsibility for scientific, competent, and kindly care of the unfortunate sick.

The study and tracing of infections to their source, the group consideration of complications, and the verification of diagnoses and analyses of fatalities by postmortem examinations, has increased our knowledge and insured to patients better care and better prognoses.

The insistence upon adequate records has resulted in the more intensive study of the patient's disease, insured fewer unexpected complications, and lowered the mortality rate. This scientific staff activity has resulted in better training of internes and stimulated the aspiring surgeon to seek his training by assistantship to competent men rather than to acquire his knowledge by incompetent surgery upon a confiding public. From this intensive study of disease, availability of adequate records, and the facilities afforded by the College through its literary research department and circulating package library, the literature of medicine has been enriched by many valuable contributions, and, equally important, the surgeon has been stimulated to keep informed as to the advances of medical knowledge through constant reading of current literature.

Our district clinical meetings have increased our knowledge of local problems, helped in the educational program, and shown that equally good surgery is done in every part of the country.

Supported by the fellows, our commissions for the study of sarcoma, cancer, fractures, traumatic surgery, technique, and the problems of surgical research have not alone advanced medical science, but also secured for patients better treatment, less disability, and longer life.

The College of Surgeons makes no claim to being the only activating force for better medicine and better surgery, but that it has inaugurated many movements for better and more ethical service, stimulated the whole profession to higher ideals, and done much to advance the frontiers of surgical knowledge and to insure patients competent care, no one can deny.

This brief survey of the activities of your College should not be ended without some consideration of its interest in public education. Charlatanism is not a modern evil. In the 17th century quacks pretended to remove stones from the head to cure insanity. Jonna Stevens' recipe for the cure of stone, consisting of a mixture of egg shells, garden snails, swine cresses, soap, and other ingredients, was purchased for the public by act of Parliament for five thousand pounds. In some of our states today the number of pseudophysicians equals the number of those practicing scientific medicine. Conscious of our own rectitude, engrossed in the joy of scientific investigation, proud of our guild accomplishments, we stand astounded that our worth, sincerity, and scientific attainments are not universally acknowledged; that the faith healer, cultist, and quack share with us, even in small part, in the confidence of the public. With outraged feelings we threaten to expose and fight them. I suggest that the only effective measure to combat these evils is found in the education of the public as to the principles of scientific medicine and its victories over disease.

In extenuation of our failure to accomplish this it is urged that the advancement of science is not news, that the translation of the discovery of a new bacterium or a new serum into its effects upon human life and its benefits to society is as difficult to the average man as the proper evaluation of Einstein's theory of relativity is to most of us. But I question whether more dramatic pictures can be drawn than those portraying the advances of scientific medicine. How often have we reminded the public of our victory over the plague that lifted a paralyzing horror from the civilized world, that black death which carried off one-fourth the population of the civilized world, broke down all restrictions of morality, decency, and humanity, while ghouls slunk through the deserted cities afraid to rob even the putrefying bodies that littered the streets (Garrison).

How often have we paid public tribute to Gorgas, Lazear, Reed, Carroll, and Agramonte and recalled the ravages of yellow fever that in our own day devastated our cities, paralyzed industry, established shotgun quarantines in our southern cities, and left the whitening bones of thousands as mute evidence of the brave but futile

endeavor of the French to build the Panama Canal, that now, through the unselfish devotion of these physicians, permits untrammeled commerce between the Atlantic and Pacific with its beneficent influence upon the amity of nations.

How often have we told our patients of Pasteur and Lister whose researches opened the door of hope to the tens of thousands suffering from surgically curable diseases and do we mention the scientists who removed the hand of death from tuberculosis, syphilis, diphtheria, diabetes, typhoid and cholera, and many other great enemies of health and society?

The great dramatic story of the modern conquest of disease may be told ethically, modestly, and honestly and yet by its recital confirm the confidence of the public in the scientifically trained physician.

The American College of Surgeons regards the education of the public as to scientific medicine an official duty and your personal obligation.

On behalf of the officials of the American College of Surgeons, I welcome you to this fellowship of ideals in self-improvement, in the advancement of the science of surgery, and in service to the public.

James R. Angell

THE LAITY AND THE PROFESSION OF MEDICINE[1]

JAMES R. ANGELL, PH.D., LITT.D., LL.D., A.M., NEW HAVEN, CONNECTICUT
President, Yale University

I COUNT it a great honor to be chosen to deliver your Fellowship Address upon this occasion, which in other years has been graced by so many distinguished men, not a few of them famous surgeons from abroad. And I may claim some slight right to be in this distinguished company, despite my lack of an M.D. degree, for several eminent surgeons of your group have, at my anatomical expense, extended their knowledge of the obstinacy and eccentricity of the human frame. As a layman, I do not presume to speak on technical matters; but I do propose to discuss briefly, and upon your sufferance, certain aspects of medicine in which the layman and the doctor have a common interest.

Medicine is the one profession whose controlling purpose is to make itself more or less unnecessary—in other words to commit suicide. Not that any such result is imminent in this generation, but that it may well approach realization in the not remote future, and, in any event, that the nature of the profession and its main business may easily take on quite a different aspect from that which we know today. The extraordinary ascendancy which has been gained over many of the more devastating of communicable diseases, the definitely advancing mastery over many menacing organic and metabolic diseases with surer and earlier diagnoses, the dramatic developments of a thousand kinds in surgery, the widely successful public health measures in their control over water and food, the slow but steady spread of sounder notions of hygiene, both physical and mental, including a far larger devotion of time and interest than formerly to wholesome outdoor sports, give us, on the far horizon, the vision of a day when the sheer bulk of human bodily ailments will be enormously reduced. What eugenics may do to breed out poor strains and so further diminish needless human misery, no one can predict; but it is unthinkable that reasonable, but drastic, measures will not be found to curtail the number of births of the seriously unfit, to say nothing of controlling births in excess of the possibilities of a well conditioned population.

But, in the meantime, it may not be unbecoming in a layman to raise a slightly protesting voice against the deluge of criticism poured out upon the medical profession (not a little of it emanating from medical men) and to insist that the public has a vital interest in seeing to it that, while abuses are abated, the essential value of the physician and surgeon to the community is not crippled by dubious restrictions, and that the circumstances of medical practice are not made so unattractive, both financially and professionally, that the quality of the men drawn into the profession will suffer. There is no profession in which it is more important that men of the highest intellectual and moral caliber be recruited, for even the most materialisticly minded doctor has now and again to perform the functions of the priest as a cure of souls, and, as such, he must be both wise and sympathetic. He will, if successful, be of necessity something of a practical psychologist, for men's minds are of the essence of their personality and it is always the person who is sick, and not simply his heart, or his liver—or even his pocketbook—and if he comes into conspicuous position of large power, the physician will also need all the resources of the most skillful and judicious statesman. Moreover, the common daily duties of his professional routine demand for their effective discharge the devotion of trained intelligence of a high order.

Because of these considerations and many others like them, it is in the deepest interest of the public to exercise caution in any compulsory methods designed to bring about changes which, although apparently desirable, may carry in their train consequences far more evil than those they were devised to correct. Human experience is full of such lessons. You bring in parasites, birds, and animals to destroy some pests which menace crops, and in the end your relief forces may do more damage than the foes they were introduced to exterminate. In medicine itself, we have in the United States had a striking instance of what may occur under similar conditions. We elevated the standards of our medical schools so widely and so fast that we drove out into schools of faddists, many of them probably outright fakers, large numbers of students who would otherwise have gone to the weaker medical schools. Indeed, new cults sprang up and forthwith organized schools chiefly to exploit this situation. Which is the greater evil, the present or the earlier conditions, I do not pretend to say; but the result of our well intentioned effort has been far from unequivocally good and certainly very different from our antici-

[1]Fellowship Address presented before the Convocation of the American College of Surgeons, New York, October 16, 1931.

pations. Again, our physicians have generally pooh-poohed the bearing of the mind on disease as a matter of definite scientific medical treatment, and over night freebooters by the thousands spring up to exploit the genuine market so created.

We are all familiar with the common lines of attack on medical procedure. We know that the United States has approximately twice as many doctors in proportion to the population as England and Germany, and nearly four times as many as Sweden. We know that, despite this fact, the supply of medical service to rural areas is grossly inadequate and that even in the cities a large amount of serious illness constantly occurs without medical aid. We have reason to believe that approximately 6 per cent of the population is at any one time incapacitated by illness and that probably 250,000,000 working days are each year lost by illness, not a little of it wholly needless. We know that, while the average family medical bill per annum is roughly one hundred and twenty dollars, the charges for many families are far above this and that, more often than not, they fall where they can least well be borne, and are coincident with a loss of income, partial or complete. We know that some medical men are ruthless in their charges for services, making Shylock look like a pure philanthropist; that fee splitting still goes on; that needless operations, and probably useless but expensive treatments, are ordered by some surgeons and physicians; that the shyster is abroad in the land and that the patent medicine business is still flourishing, thanks largely to human credulity, human imagination, and the assistance of a sometimes venal press. We know that so little educational work has been done that preventive medical measures are little appreciated and often poorly supported. For example, four-fifths of our rural counties have no organized health service at all. We know that doctors are by no means as yet unanimously conceiving the health of the general community as their responsibility, and that they are often unimaginative and obstructive in their attitude toward the development of a competent personnel for public health work. We know that hospitals, despite the large number of free beds in many of them, cannot care for all community needs, and that, with few exceptions, if they comply with proper medical and nursing requirements, they are operated with the utmost financial difficulties. We know that our medical training leaves much to be desired, that the young doctor brought up in a hospital interneship, where skilled nursing and every scientific facility is immediately at his hand, may be ill prepared to face the exigencies of practice where he cannot have access to these aids. We know that this same type of training tends to stress interest in the special disease, rather than in the patient as a human being. We know that the training of specialists is in many respects grotesque, and that the financial temptation to set up as a specialist, despite the lack of suitable preparation, is to many young men irresistible. We know that hospitals should be schools for the continuation training of physicians and that as yet such is rarely the case. We know also that hospitals should be developed as community medical centers for the education of the public in health measures, and this also is all too infrequently the fact. We know that existing health agencies should be co-ordinated and brought into relations of effective co-operation for the community, whereas there is at present overlapping and costly competition. The list of these shortcomings need not be further extended.

Whether for any, or all, such difficulties the cure is to be found in state controlled medicine, in industrial and health insurance methods, in co-operative clinics, or in some other devices aimed at bringing competent medical service within the reach of every citizen, at a price he can afford, remains to be seen.

I am by no means unaware of the narrow minded and exclusively self-seeking attitude of a good many practitioners, who see in every social movement affecting medicine simply one more effort to rob them of a livelihood, and forthwith devote all their energies to digging in where they are. Their position is like that of labor, which has traditionally opposed all labor saving machinery —and always, in the long run, in vain. The public interest is ultimately bound to be paramount. It is a very natural and venial fault to prefer one's own financial advantage to any idealistic social scheme, however apparently beneficent to the public. Other professional men, to say nothing of business men, and even possibly of teachers, exhibit the same proclivities; but, in the face of this reactionary tendency, if such it be, we have to recognize that unquestionably there is a new social philosophy in the air and every phase of our life is bound to be affected by it sooner or later. This philosophy conceives the social order as under binding obligation to give its members wholesome conditions of life, protection from needless exposure, whether to climate, or disease, or moral depravity. It conceives human life as indisputably superior to money, or physical property in any form, and it is disposed to suppress, or radically modify, any agency or practice which

appears to be exploiting men for the promotion of merely financial and material gain. A good deal of it suggests the ideals of the *New Testament* and the teachings of the Carpenter of Nazareth. The repercussion of this philosophy is felt wherever men believe that they are overcharged for necessary services, or given inferior service when they require the best. This applies to transportation, to food supplies, to sundry forms of business and industry, to the maintenance of health, and to many other interests. Its motives are intrinsically humane and no thoughtful person can view its development without deep sympathy and the prayerful hope that, in its enthusiasm for a nobler and finer humanity, it may not blunder and fail by seeking, at a single step, to gain the *Utopia* which must be won, if at all, by slow and painful effort.

We should not be terrorized, or stampeded, by a mere name. The socializing of medicine, for example, may mean much or little. It may menace the profession, or it may be its salvation. Of one thing we can be sure, and that is that, in the long run, by hook or crook, society will command competent medical and nursing service, adequate in amount to meet the needs of everyone. If it cannot secure this as the result of measures voluntarily devised and perfected by the profession and its interested friends, it will look to other agencies, and notably to the government, to produce the desired results. With political methods and conditions what they are now in the United States, it is difficult to contemplate such a solution without the gravest misgivings.

On the purely financial side of the problem, there are certain observations that should in fairness be made. Despite the exploitation of the very rich by certain of our fashionable medical men, and despite the excessive fees charged by others to patients who cannot afford to pay them, there is equally no question that most doctors do a large amount of essentially gratuitous work and that the average practitioner has a very modest income. Indeed, I am disposed to agree with Mr. Filene, who, in a recent paper, declares unreservedly that the competent doctors are seriously underpaid, and, at the same time, asserts that the public has to pay far too much for the service it gets—two seemingly contradictory propositions which he attempts to reconcile on the ground that the doctors, as a profession, have not developed genuine business insight and ability, and that until modern business methods are employed, the present sources of friction will continue.

The medical fraternity as a whole is apparently disposed to stress predominantly the immediate financial disadvantages to the practitioner of many of the changes now under discussion, fearing not only that his none too adequate income is to be further curtailed, but also that he is to go the way of much small business and be swallowed up in some great machine organization. There may be basis for this fear, but to my lay mind the far greater ultimate menace which the community has to face is the loss of certain other intimate and more personal values, which I wish in a moment to stress. Ultimately the economic difficulties are fairly sure to be equitably adjusted. It will be immensely more difficult to protect and restore, if once lost, the familiar elements which I wish presently to emphasize. It is unusual for me to find myself in any sense on the merely conservative, or stand pat, side and I am not so in this case, so far as concerns the remedy of essentially bad conditions; but I am solicitous that the remedy applied be not worse than the disease.

While the virtues of the old family physician, with his historic black bag and his one horse chaise have perhaps been sentimentalized rather out of relation to reality, nevertheless he did represent an invaluable element in medicine and it will be tragic if, with all the inevitable changes which have come to pass, many of them so profoundly beneficial, and with the more drastic ones which are certain to come in the future, we cannot devise a way to restore, or retain, an appreciable part of these virtues, which were, in the last analysis, keyed to direct human relationships of friendship, knowledge, sympathy, and respect.

As I survey the general drift of the considerations to which I have drawn your attention, there are certain conclusions of which I feel sure, because they touch matters of fundamental psychology, in which I am bold enough to entertain a definite opinion. I am thus confident that any measures which substantially lessen the interest of the physician in his patient as a man, of whose personal and social status he has some direct and sympathetic knowledge, are materially detrimental, both to the patient and to the doctor—and so to the social order of which they are both members. Again any measures which seriously lessen, or outright rob, the physician of the urgent incentive to excel and to go forward steadily and rapidly in his profession are quite as much a loss to the community as to the doctor. Any measures which deprive him of reasonable economic reward for such excellence as he possesses—reasonable in terms of other social services requiring comparable responsibility, training, experience, native ability and skill—are a grave detriment to all

concerned and not least for the reason that, as in the two issues just mentioned and commented upon earlier in this paper, the attractiveness of the profession to young men of outstanding qualities would be thus lamentably impaired. Further, any measures which substantially limit the physician's responsibility for his medical judgment and actions, by subordinating him in a rigid hierarchical system, are sure to be vicious in their outcome.

Now some, or all, of these consequences may be inevitable, in order to secure advantages which society will regard as outweighing them in importance. But I cannot believe that any such actions, if taken, will fail to work out most disastrously for all our people, and I speak as a citizen and not as a doctor.

We have traditionally pitied the man who sold his birthright for a mess of pottage. It is by no means clear that we are not menaced by a similar danger in our efforts to seize a needed good which may entail the sacrifice of a still greater good. On the other hand, if under altered forms these values which I have recited can be preserved, and, much more, if they can be developed and enhanced, I should have no fear whatever of even the most extreme changes in the present conditions under which the medical profession operates. Nor should I have any fear that society would not only permit, but insist, that men who render such indispensable service should be accorded unequivocal social prestige and a thoroughly adequate financial reward.

We may justly ask the medical man to accept whole-heartedly the new gospel of an enlightened social order, exercising due care over all its members and with discriminating favors accorded to none. In essence this is the true spirit of American democracy. But we should not in our own selfish interests, were there no higher motive, compel him to work under conditions which paralyze at the outset all the most powerful and worthy of his impulses to professional service of the highest character. As a layman then, I wish to record my profound sense of gratitude to the profession which you adorn and to which humanity has from time immemorial been so indebted, while I assure you of the sincere desire of many of your fellow citizens to cherish and protect the sacred values confided to your care.

OPHTHALMOLOGY, OTOLARYNGOLOGY

THE ACTIVITIES OF THE OTOLOGICAL RESEARCH LABORATORY OF THE JOHNS HOPKINS UNIVERSITY DURING THE PAST FIVE YEARS[1]

SAMUEL JAMES CROWE, M.D., BALTIMORE

THE Otological Research Laboratory of the Johns Hopkins University was organized in 1924 for the purpose of studying the finer anatomy, the pathology, and the physiology of the ear. The pathology and anatomy may be demonstrated with temporal bones collected at random in the autopsy room, but a study of the physiology of the human ear is a more complicated procedure. For example: No temporal bone is of value in this investigation unless an accurate test of the function of the cochlea and vestibular apparatus was made before death. The specimen must be obtained within a few hours after death. The preparation of good histological sections is so essential, that approximately 1,000 temporal bones and several years of concentrated effort of the entire laboratory staff were required to develop a satisfactory technique for fixation, decalcification, and embedding. Our plan from the first was to examine with the greatest possible accuracy the hearing of every hospital patient whose general condition made it seem likely that he would come to autopsy. Many of these patients were found to have normal hearing. The histological sections of the temporal bones of such cases have been of great value, however, in developing a histological technique that is free from artefacts.

The most important and perhaps the most difficult task that has not been solved, is the interpretation of the audiometer curve and tuning fork tests. It is absolutely essential that the otologist should be able to determine from the tuning fork tests, the audiometer record, and the general diagnostic study: (1) whether the lesion is located in the middle ear, the inner ear, or the auditory nerve, or, (2) whether there is a lesion in both the middle and inner ears. He must also be familiar with the common etiological factors of the various types of deafness. A clear understanding of the cause and pathology of hearing defects is absolutely essential. However, a clear understanding of the physiology of the various structures of the middle and inner ears must come first.

The brilliant work of Wever and Bray[2] has given us a method of studying in experimental animals the part played by each separate structure in the middle ear in the transmission of sound. A detailed description of the experiments has been published.[3] The most important conclusions are: (1) the clearness and resonance of the voice is diminished by any change in the length and diameter of the external auditory canal; (2) pure lesions of the drum that interfere in no way with the ligaments or movements of the ossicles have very little effect on the transmission of words or tuning fork tones; (3) any experimental lesion that tends to interfere with the movements of the ossicles or *increases* the rigidity of the ossicular chain causes a marked impairment in the transmission of *low* tones; (4) division of the tensor tympani muscle, which *decreases* the rigidity of the ossicular chain, causes a marked impairment in the transmission of *high* tones; (5) puncture of the round window membrane, which allows a drop of the perilymphatic fluid to escape, results in a *profound loss* in the transmission of all sounds; (6) pressure on the round window membrane, which makes it tense and reduces its mobility, increases the sensitivity of the cochlear end-organs and the clearness and intensity of words and tuning fork tones are *increased* approximately 50 per cent.

These facts could never be demonstrated in a patient or in histological sections of the human ear, because infection usually involves to a greater or less degree all of the middle ear structures. This type of experimental work, together with the functional, histological, and statistical studies on patients, will in time enable us intelligently to interpret the history; the general physical examination and laboratory tests, the local findings in the ear and upper air passages, the various tuning fork and audiometer tests make it possible to locate the lesion and understand its cause. When this has been accomplished we may hope to arrest the progress of deafness or possibly prevent its development.

[2] Wever, E. G., and Bray, C. W. The nature of acoustic response: the relation between sound frequency and frequency of impulses in the auditory nerve. J. Exper. Psychol., 1930, xiii, 5.

[3] Hughson, Walter, and Crowe, S. J. Function of the round window, an experimental study. J. Am. M. Ass., 1931, xcvi, 2027–2028.
Crowe, S. J., Hughson, W., and Witting, E. G. Function of the tensor tympani muscle. Arch. Otolaryngol., (in press).
Crowe, S. J., and Hughson, Walter. A new method for the study of the physiology and pathology of ear. Monatschr. f. Ohrenh., (in press).

[1] Abstract of paper read at a special meeting of the Section of Otolaryngology, New York Academy of Medicine, October 15, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

SOME INTIMATE STUDIES OF NASAL FUNCTION

Arthur W. Proetz, M.D., St. Louis, Missouri read an interesting paper on "Some Intimate Studies of Nasal Function; Their Bearing upon Diagnosis and Treatment."

CLINICAL PHASES OF INDUSTRIAL INJURIES OF THE EYE AND ORBIT[1]

EDWARD B. HECKEL, M.D., PITTSBURGH, PENNSYLVANIA

A FOREIGN body within an eyeball is a serious condition, so serious in fact as to justify the statement that an eye with a foreign body in it is, potentially speaking, a lost eye. The patient should have all the niceties of aseptic attention which a cataract patient should have.

When the patient is first seen, in our clinic, a careful inquiry is made as to the patient's occupation, and the character of tools he was using and his exact position at the time of the accident. The eye is carefully inspected to ascertain, if possible, the entrance wound, and this should include an ophthalmoscopic examination to determine the condition of the refractive media. The eye is then flushed with a solution of mercury cyanide 1:3000 and a few drops of atropine solution[2] is instilled into the eye. Following this, fifteen hundred units of tetanus antitoxin are administered and an X-ray is ordered to ascertain the presence of a foreign body and, if one is there, to localize it. The localization should correspond in position with the history of the case. If it does not, a second localization is made, and that if practicable, by another roentgenologist.

Many cases may be termed "border-line cases"; the frank cases are comparatively simple. In any event care and exactness should never be sacrificed in an attempt to finish the work quickly.

When one is reasonably sure of the localization, it is well to concentrate upon it, so that the eye and the position of the foreign body may be visualized. For the operation the patient is placed in a recumbent position and made comfortable. We long ago discontinued the sitting posture of the patient with a large magnet before him. We prefer to use a hand magnet, and have one of our own construction which is 7.75 inches long and weighs 6.5 pounds, with a solid removable core, which is 12.25 inches long, with a tapering point at one end of 2.5 inches. The weight of the complete magnet is 7 pounds, 6.5 ounces. The removable core has several advantages: (1) It can be sterilized by boiling. The magnet then is wrapped in a sterile towel and placed on a small table covered with sterile towels. Only the sterile core is permitted to come in contact with the eyeball. (2) The removable core enables one to determine in a second or less, whether the magnet is functioning properly. The core is partly placed into the magnet. The current is then turned on, and if the core jumps into the magnet instantly, it indicates that the magnet is, so to speak, "on the job." We use a direct current, as alternating current magnets are not satisfactory. (3) The solid core has another advantage over one in which small tips are applied, for no matter how perfectly the tips may be made to fit, there is not complete magnetic union. The ideal magnet should have a large saturated field, for the value of a magnet for our purpose does not depend on its lifting power, but on the saturation of the field. An eye with a suspected foreign body in it should never be approached with the magnet while the current is on.

Whether the entrance wound is used, or a new opening is made for the removal of the foreign body depends on the location of the foreign body. The closer we can approach the foreign body with the point of the magnet, the easier it is to get it. When the foreign body is within the magnetic field it becomes a magnet and, if there is nothing to prevent, it immediately jumps to the tip of the magnet. It does this over the shortest possible course.

One should not hesitate to make a new opening through the sclera when necessary. In doing this, local anæsthesia being used, two sutures are placed through the conjunctiva and sub-conjunctival tissue about 5 millimeters apart, over the site of the proposed opening. These are held apart by an assistant, and the tissues are severed down to the sclera. The incision through the sclera should be made with a sharp pointed cataract knife and parallel to the meridian of the eye. The knife should be thrust boldly into the eye at a right angle to the sclera and the incision enlarged on withdrawing the knife. It should always have a slight curve instead of a straight line, which facilitates the entrance of the tip of the magnet and the removal of the foreign body. The length of the incision is governed by the size of the foreign body, never larger than is considered necessary. Introduction of the tip of the magnet into the vitreous does no harm.

All instruments, such as the speculum and forceps, should be non-magnetic and made of brass. While the assistant is holding back the conjunctival tissue, the tip of the magnet is carefully introduced into the entrance wound, and the current applied. After a few moments, the magnet is withdrawn carefully. If the foreign body is not on the tip, the current is shut off and the magnet is re-introduced, after which the current is again turned on and another trial is made. Care should be exercised not to have the current turned on too long, for the magnet gets warm and eventually hot. After removal of the foreign body, the eye is flushed out but no sutures are applied. The blood supply of the overlying tissues is so good that the wound heals rapidly. Atropine is used locally and sometimes iced pads are used for a few hours. In most cases a sterile dressing is applied.

[2] Atropine gr. I ad drs. II Sol. Hg cyanide 1:3000.

[1] Abstract of paper read at a special meeting of the Section of Ophthalmology, New York Academy of Medicine, October 14, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

FOREIGN BODIES IN THE EYEBALL[1]

HENRY S. MILES, M.D., BRIDGEPORT, CONNECTICUT

THE conclusions here presented were reached from my experiences in treating patients who had or had had foreign bodies within the globe, together with a review of 78 history cards that were conveniently at hand.

The direct cause of the accidents in 56 instances was hammering; the remaining causes were 11 different kinds of work on metal and wood. There are no data to show how many of these workers were wearing their goggles, but most of those questioned did not have protectors on. Eighty-nine per cent of the foreign bodies in this series were of steel. The other substances were glass, wood, tin plate, copper, and brass. Several eyes totally destroyed at once by the explosion of a great many cartridge primers were not included.

The foreign bodies were located as follows: 14 were anterior to the lens, 18 were in the lens, 32 were in the vitreous, 5 in the retina, 3 in the sclera, and 6 passed completely through the eyeball into the orbit. Four of the pieces of steel passed through an eyelid before entering the sclera.

When the particles had evidently stopped in the lens, or anterior to it, a hand magnet was first used, and with this alone 8 pieces were removed. It was necessary to use the large magnet to remove 8 others from the lens. The bits of steel were so small in 2 instances that the giant Haab would not dislodge them; one lens was removed with the particle in it, the other piece remained within the lens which was only partially opaque.

It is conceded that with steel in the vitreous or the posterior coats of the eye the problem is more difficult. We must find out at once just where the offender is. Very often we need the help of a roentgenologist in our search for an opaque lens or blood in the vitreous is apt to be present to cloud the picture.

There are occasional slips by the X-ray operator. In not a few cases the foreign bodies are plotted too small. Negative reports have come to me in 5 instances where steel was subsequently removed. I am one of the ophthalmologists who uses the giant magnet, for overlooked pieces are small and will usually come into the anterior chamber.

It has been my custom to bring all the pieces measuring 3 millimeters or less in the longest diameter around the lens and through the pupil. I feel sure that I have never injured a lens by so doing. In drawing particles forward we are careful of our aim so the pull is not toward the ciliary body. All mine have escaped; at least, they did not tarry there.

I make a fair sized incision in the cornea, even though some aqueous may be lost. I complete the delivery from the anterior chamber with the large magnet in most instances to avoid the introduction of another instrument, though it frequently might be done more handily with a small one.

In the series of steel cases, 25 pieces were extracted around the lens, 8 from within the lens, and 9 through the sclera, with the aid of the giant magnet; 8 were removed with the hand magnet. When steel was removed through an incision in the sclera a small nick was made at right angles, to favor gaping. It was necessary to go into the vitreous but once. A large piece with barbs on it was disengaged with a strabismus hook on the giant magnet tip. Most of the cases in which removal was through the sclera did badly. There were some detached retinas, and it may prove good practice in the future to cauterize about the wound in an endeavor to glue the retina and keep it in place. In one instance the retina was separated at the point of entrance.

The results were usually good when the foreign bodies were forward, and not so good when they were back of the lens. This latter was especially true of large pieces, or those extracted through the sclera. Many eyes were blind when first seen and several so badly injured that there was little hope. We promised nothing and secured all we could; not infrequently we were pleased if a good looking eyeball was retained. Five had to be enucleated but I have seen no case of my own with sympathetic trouble. Twenty-four eyes had no sight in the end, but remained quiet. Ten patients of the series were returned to referring oculists and final vision was not recorded. Nine had vision of some use and 23 had 20/40 to 20/15. One with double perforation had 20/30 and another 20/20. Seven others did not have their vision recorded. Several lens cases could have been improved by operations. Some people are seeking compensation who declare that they see very little, though we know that we have obtained excellent results.

In Connecticut, 20/200 or less is considered a total loss, industrially. Cataract patients have come under this head, though they may see, with their correction, 20/20. They cannot wear the strong lens if the other eye is anywhere near normal. It is my opinion that such cases should have a separate rating in compensation schedules.

Steel will work forward at times as well as copper and brass; twice pieces appeared in the anterior chamber of disorganized eyes. A disc of brass 3 millimeters in diameter entered an eye causing a cataract. It settled in the vitreous. There was just a slight irritation but sight was lost. At the end of about 3 months the disc presented itself through the iris below. It seemed an easy matter to open and take it out with forceps. I tried it. At the first attempt it retreated into the gel. In a week or so it was out in front of the iris again. I operated this

[1]Abstract of paper read at a special meeting of the Section of Ophthalmology, New York Academy of Medicine, October 14, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

time with the patient sitting straight up, using Knapp's foreign body hook, but it would not take the bait, and I lost. I decided that at the next trial the young man should lie with his face downward as did a patient operated upon by Dr. Robert Reese. Shortly afterward he went to a military camp. Upon his return he walked into my office with a grin. I said to him, "You have that piece of brass." His reply was, "Yes, after boxing with a chap, my eye felt funny. I took a mirror, saw the thing protruding and picked it out with my jack-knife."

Foreign bodies within the eye furnish a variety of conditions and abound in many delightful uncertainties.

DEMONSTRATION OF MICROSCOPICAL PREPARATIONS OF EYES CONTAINING FOREIGN BODIES[1]

BERNARD SAMUELS, M.D., New York

FEWER intra-ocular foreign bodies are encountered today than formerly, owing to the fact that the electric drill is now used instead of the hammer and because precautions are taken in requiring the use of goggles.

According to Dr. George Sloan Dixon, of the New York Eye and Ear Infirmary, 25 years ago it was no uncommon occurrence in that institution for 5 or 6 X-ray pictures of foreign bodies to be taken in an afternoon. However, in the year 1930, there were but 30 cases of foreign bodies of the globe at the Infirmary in a total of over 30,000 patients. A fragment the size of the point of a cambric needle, according to Dr. Dixon, will cast a shadow and may be accurately located.

It is said that foreign bodies enter the globe by way of the cornea two hundred times more frequently than by way of the sclera, because the cornea has a greater curvature and is more exposed than the sclera. The more dangerous route is through the sclera, almost invariably causing intra-ocular hæmorrhage from damage to uveal vessels. Intra-ocular foreign bodies are mostly minute, with sharp edges. The smaller they are the less likely they are to introduce bacteria into the globe. Should bacteria be introduced the eye is lost, not from the presence of the foreign body but from infection.

Of all the intra-ocular foreign bodies, iron and copper concern us the most—iron, because it is so commonly found and copper because its presence usually means a bad prognosis. The latter, although it may be sterile when introduced, generally has a most deleterious effect. Its salts may be so irritating to the tissues as to set up an actual purulent inflammation resulting in panophthalmitis and destruction of the globe. On the other hand, the action of the fluids of the eye on iron produces salts that cause a slow degeneration of those intra-ocular structures that are of epithelial origin, especially the retina. The macular region, according to the preparations, is particularly apt to be affected by the impregnation of iron.

It is seldom that a foreign body lodges in the middle layers of the fibrous tunic of the eye. If it is not arrested by the anterior surface, it is apt to traverse the entire thickness. Generally the force is not spent until the particle has attained the vitreous cavity. This explains why foreign bodies are not often seen in the anterior chamber.

It is characteristic of foreign bodies, of whatever size or description, that they form a bed of connective tissue in which to lie. This is true no matter where the location of the foreign body may be. Thus a particle lying on the posterior surface of the cornea, far removed from any vascular tissue, nevertheless becomes encapsulated. The capsule or bed consists of granulation tissue immediately around the substance, enclosed by dense connective tissue. The size of the bed varies according to the size of the foreign body and the irritation produced by it. Thus the bed may occupy half the anterior chamber or half the vitreous cavity.

Foreign bodies may be sent with such force that they penetrate the fibrous tunic twice coming at rest in the orbit. Most eyes suffering double penetration are greatly damaged or lost on account of the bleeding that ensues from the uveal tract, the broken blood vessels pouring blood into the vitreous from two points, that of entrance and that of exit.

In large perforations, and it has happened in small ones, cilia may be dragged into the eye and left there after the instrument is withdrawn. It is surprising to what depth, even at the optic nerve, cilia may be found. Wherever located, whether free in the anterior chamber or not, they are irritating and are sure to set up inflammatory reaction in time.

A splinter of wood within the globe is almost certain to cause the loss of the eye within a short period. In the first place, wood, unlike a fine particle of iron, is usually infected, and in the second place wood itself seems to be very toxic. Glass probably is the least injurious of all substances.

Eyes containing foreign bodies have been removed because the capsule or bed of the foreign body has

[1]Abstract of paper read at a special meeting of the Section of Ophthalmology, New York Academy of Medicine, October 14, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

been mistaken for a tumor. This is particularly the case with foreign bodies that have lodged in the stroma of the iris, where they may become surrounded by exuberant granulation tissue which in its rapid growth and shape may simulate a neoplasm or a tuberculous process. In a similar way, the capsule of a particle lodged on the inner surface of the ciliary body may cast a shadow on transillumination and lead to a suspicion of malignancy.

If a foreign body is seen suspended in the vitreous there is not much chance of its remaining there because its presence causes a liquefaction of the vitreous so that in time it will sink to the most dependent part. A favorite seat for foreign bodies found by accident in sectioning eyes, seems to be a bed on the retina below, just back of the ora serrata—the point to which they have sunk after the liquefaction of the vitreous. Foreign bodies on the retina, because of the contraction of their capsule, cause the retina to detach, and with this detachment the foreign body changes its position. Such possibilities are to be borne in mind in repeated X-ray examinations made from time to time.

Sooner or later hyaline and other degenerative changes are apt to take place in the fibrous capsule of a foreign body, thus causing it to break down. When this happens, the poisons generated by the foreign body itself and by the broken down tissue which is set free, may produce active inflammation and there may be set up sympathetic ophthalmia. An eye containing a foreign body is never to be considered out of danger.

WORKMEN'S COMPENSATION PROBLEMS OF INTEREST TO OPHTHALMOLOGIST[1]

V. A. ZIMMER, M.D., ALBANY, NEW YORK
Division of Workmen's Compensation, Department of Labor, State of New York

FEW doctors realize their importance in workmen's compensation administration. In ordinary cases the physician has the single duty of diagnosing and treating ailments. In compensation cases, however, he owes the duty, to the claimant and to society, of determining whether and to what extent the disability and its cost are chargeable against industry.

In no branch of medicine is the responsibility more pronounced than in ophthalmology. No branch requires closer study of cases or keener professional analysis to bring about equitable disposition. Accurate measurement of vision is frequently difficult because of factors over which the doctor has no control—the non-co-operation of a patient, illiteracy, changing of pathological conditions, etc. Eye injuries are numerous and expensive. Early neglect or carelessness brings tragic results in loss of sight—infection due to the removal of foreign bodies with dirty handkerchiefs, the failure of the first aid nurse to recognize the seriousness of a condition, and even apparent lack of thoroughness on the part of the doctor.

In eye cases the Department will not close a case unless a medical report is filed, and it makes a special effort to have claims filed in every reported instance because of the frequency of cases in which loss of vision has resulted after the lapse of the legal period during which a claim may be made.

The Department is constantly pointing out to doctors the necessity for making and retaining complete case records including visual tests and descriptive pathology of the injured eye. These data are of grave importance in cases in which the issue is one of activation or precipitation of a dormant disease and for comparative purposes in measuring the visual loss in the injured eye.

Under the theory of compensation principles, firmly fixed by court interpretation in this State, traumatic activation of a latent condition is the equivalent of causation. It must be determined in a very large number of cases whether and to what extent the injury incited the development of the diseases which in themselves are capable of reducing or destroying vision.

In order that physicians may have a better understanding of the scope and purpose of the law and detailed information as to its administration, the Department is assembling valuable data from studies of the large number of eye cases presented. This material will be available to any member of this society who may be interested from the standpoint of research.

[1]Abstract of paper read at a special meeting of the Section of Ophthalmology, New York Academy of Medicine, October 14, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

WHAT IS BEING DONE TO PROTECT THE EYES OF INDUSTRIAL WORKERS AND WHAT MORE NEEDS TO BE DONE[1]

LEWIS H. CARRIS, M.D., NEW YORK
Managing Director, National Society for the Prevention of Blindness

THERE is reason to believe, from the voluminous data in the hands of the National Society for the Prevention of Blindness, that accidental injuries of the eye now constitute the greatest single cause of blindness. Tremendous progress has been made toward eradication of ophthalmia neonatorum, which for some time has been the leading cause of blindness; the incidence of eye diseases generally has been greatly reduced through preventive and curative medicine and surgery; great strides have been made in the correction of visual defects, in the elimination of excessive eye fatigue, and in the promotion of general hygiene. But it seems that simultaneous with all this progress there has been a more or less steady increase in the frequency and severity of accidental eye injuries, particularly as the result of occupational hazards.

Part of this increase is undoubtedly due to the greater mechanization of industry, part to the general speeding up of the work of the individual man or woman in factories, and part, until recent years, to the tremendous increase in the number engaged in industrial occupations.

The employers of New York State are, on the whole, as progressive as any in America in the matter of accident prevention. Nevertheless, an analysis of eye injuries during the last 6 years, prepared for the National Society for the Prevention of Blindness by Dr. E. B. Patten of the New York State Department of Labor, shows a more or less steady increase in the number of permanent total disability and permanent partial disability cases, from 2,247 in 1925 to 3,200 in 1930. The compensation paid for these eye injuries shows a slight reduction, from $1,902,000 in 1925 to $1,792,000 in 1930. And 1930 was not a particularly busy year for New York's industries. A similar situation is revealed in Pennsylvania—another industrial state in which the employers are much interested in accident prevention. The records of the State Department of Labor and Industry of Pennsylvania show only slight reductions in the number of eyes lost in recent years and a considerable increase in the amount of compensation paid for permanent eye injuries. In 1927, 588 eyes were lost in Pennsylvania and $882,000 was paid as compensation for these and other serious eye injuries. In 1929, 565 eyes were lost and over $1,000,000 was paid as compensation. Last year, despite the falling off of industrial activities, 520 eyes were lost and $940,000 was paid as compensation. Notwithstanding all the splendid accomplishments of the industrial safety movement, the problem of protecting the eyes of industrial workers is today as serious as it was 5 or 10 years ago.

The sight of men and women in industry can be safeguarded by three vital means: through mechanical devices; through training and education of workers, supervisors, and managers in safe practices; and through proper administration and supervision.

Goggles and headmasks are the most common, and from many points of view, the most effective means of eye protection in industry. Tremendous progress has been made in the design and construction of goggles; they are far more comfortable, and more substantially made, though lighter in weight; lenses withstand much greater stress; and the glass when shattered is much more likely to remain in the goggle frame. The strides that have been made in the provision of goggles to workers in hazardous occupations are best illustrated by two sets of figures: a large electrical products concern reports that 10 years ago it spent little more than $100 a year for goggles; today this company spends in the neighborhood of $100,000 a year for this and other forms of mechanical eye protection; a large optical goods company reports that 15 years ago its sales of goggles and headmasks totalled $50,000 a year; last year this same company sold $1,300,000 worth of goggles and masks.

Practically all of this progress, however, occurred in several scores of large industrial concerns. In the opinion of many men who are continuously in touch with this problem at first hand, the small plant is today no farther ahead than it was 10 or 15 years ago in the matter of providing mechanical safeguards for the eyes of its employees. And in the aggregate, the small plant constitutes the bulk of American industry. Much the same is true with respect to the other mechanical safeguards, glass and metal shields at the point of operation on machine, engineering revision of process and equipment, and general plant arrangement and maintenance.

In the training and education of workmen, foremen, safety committeemen, safety inspectors, and safety engineers, important contributions have been made by the various safety associations, by a few outstanding corporations, by some state industrial commissions, and by a few casualty insurance companies. However, up to a year or 2 ago there was not a single engineering school or college in America offering a course for the training of safety engineers, except New York University which gave such a course in its extension department. Today, 20 years since the beginning of the safety movement, facilities for the training of the men who are to be in charge of accident prevention in industry are woefully inadequate. And within the individual shop—except a few of the larger and more progressive cor-

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porations—the training and education of workmen and foremen in safe practices are either completely ignored or subordinated to the very intensive education, training, and supervision given in methods of speeding up production, lowering costs, and maintaining standards of manufactured products.

A recent analysis of the circumstances surrounding 70,000 accidents has led Heinrich, of the Travelers Insurance Company, to the conclusion that 98 per cent of all industrial accidents are preventable, and of these 88 per cent could be prevented by proper supervision and administration.

One detail of industrial administration is of special interest, and that is the mandatory goggle rule which requires every workman in a hazardous department or plant to wear goggles at all times on penalty of discharge for violation of the rule. It is our understanding that such a rule has for a number of years been enforced in the Pullman Company, the American Car and Foundry Company, the Union Pacific Railroad System, and in some plants of the United States Steel Corporation, and that in all these companies the radical reductions in serious eye injuries are attributed largely to this rule. While this is common knowledge within the safety profession, the vast majority of industries have not yet become sufficiently interested to create and enforce the mandatory goggle rule.

There are two other important aspects of plant administration and supervision which justify Mr. Heinrich's assignment to this factor of a possible 88 per cent reduction in accidents. I refer, first, to the fixing of responsibility upon individuals for individual accidents; and, second, to the securing of the genuine interest of plant executives and owners in thorough-going accident prevention. The Union Pacific Railroad System, which for many years has taken first place in almost every nationwide safety contest and whose record is hardly approached by any other large railroad, attributes this enviable record primarily to these two items of administration and supervision: When every workman, foreman, and supervisor knows that every accident will be investigated and that the careless person, irrespective of his position in the plant, will be disciplined, and on repeated carelessness discharged, accidents cease to happen. Similarly, when the chief executive of an industry really becomes interested in preventing accidents and ceases to be content merely with the financial protection provided by insurance, the frequency of accidents is radically reduced because the many known ways and means of their prevention are conscientiously used by workmen, foremen, and managers who value their jobs.

What can the industrial physician or surgeon do in this situation? Frankly, there is little the medical man can do toward the direct prevention of accidents. There is very much that he can do in the protection of workers against the health hazards of industry. As is well known, there are many serious health hazards affecting the eyes of industrial workers that often lead to total blindness. This is especially true because of the steadily growing use of poisonous chemicals in industry.

There is a great deal, however, that the industrial physician or surgeon can do to help this situation indirectly; he can—often more effectively than the safety engineer, the insurance inspector, or anyone else—inspire the genuine and thoroughgoing interest of executives in the elimination of accident hazards as well as of disease hazards.

PROGNOSIS OF CERTAIN EYE INJURIES[1]

ELBERT S. SHERMAN, M.D., NEWARK, NEW JERSEY

PROGNOSIS in industrial eye injuries is of increased importance since the enactment of workmen's compensation laws. In each case the eye surgeon must make an estimate of the percentage of permanent functional loss, if any, resulting from the accident. Frequently, improvement continues for many months after the occurrence of the accident. This is particularly true of corneal scars, lens and vitreous opacities, wounds of the retina and choroid, and paralysis of the ocular muscles.

Visual impairment from trauma is due to scars which involve the central area of the cornea more frequently than to any other one cause. Only by observing these cases over a long period does one realize how completely some of these opacities fade out. An increase of visual acuity from 20/200 or 20/100 to 20/50, 20/40, or 20/30 is not uncommon during 6 months to a year following the accident.

Partial or limited opacities of the lens caused by a small wound in the capsule which closes quickly, sometimes clear up partially or completely. Recently, the author saw a large rosette-shaped traumatic opacity in the posterior part of the lens clear up completely in 5 months with a resulting improvement of vision from fingers at 2 feet to 20/20.

The majority of penetrating wounds of the eye are caused by flying particles of metal, usually steel. The prognosis of these injuries depends on many factors. Some of these are: (1) the nature of the foreign body, (2) its size, shape, and velocity, (3) its location in the eye and the anatomical destruction, (4) infection, exogenous and endogenous, (5) promptness of treatment, (6) skill, experience, and equipment of the surgeon.

Most intra-ocular foreign bodies, being of steel, are magnetizable and can usually be removed with a magnet. If retained they are likely to cause, sooner or later, chronic uveitis, siderosis, or other destructive changes. Exceptionally they are tolerated without damage for many years. A personal experience with a piece of non-magnetic steel in the vitreous, which was not removed, is reported. The eye remained quiet but a complicated cataract developed later. Other cases are reported in which foreign bodies passed completely through the eyeball with comparatively little damage. Focal infection is often an important factor in causing serious complications in ocular injuries.

As a rule, the more promptly an intra-ocular foreign body is removed, the more favorable is the prognosis. During the first day or two, it can often be removed through the wound of entrance. The necessary manipulation is easier and safer before the eye has become inflamed.

Sympathetic ophthalmia is uncommon in adults. It occurs more frequently in children. Enucleation of hopelessly injured eyes during the first week is the one sure preventive. In over two hundred cases of serious intra-ocular injury, in many of which there was prolapse of the iris or injury of the ciliary body, the author has had only one case of sympathetic ophthalmia. This was in a child and a prompt enucleation, on the first appearance of uveitis in the sympathizing eye, saved the eye.

When there is a wound through the cornea or limbus, prompt and wide abscission of prolapsed iris, and covering the wound with a conjunctival flap will often avert serious complications.

It is sometimes difficult to decide when to advise enucleation. Danger signs that should always be heeded are persistent, unabated irido-cyclitis, increasing lowering of the intra-ocular tension, and turbidity of or cells in the aqueous of the uninjured eye. A retained foreign body in an eye with useful vision is not of itself, in the absence of symptoms, an indication for enucleation.

[1]Abstract of paper read at a special meeting of the Section of Ophthalmology, New York Academy of Medicine, October 14, 1931, as part of the program of the Clinical Congress of the American College of Surgeons.

CLINICAL ASPECTS OF INDUSTRIAL INJURIES OF THE EYE AND ORBIT[1]

GEORGE H. CROSS, M.D., CHESTER, PENNSYLVANIA

THE character of ocular injuries in a locality varies with the kind of industries in that particular region. However, foreign bodies in the cornea result from accidents in most classes of industry and comprise at least 60 per cent of all ocular cases. In an analysis of 4,541 ocular injuries occurring in industry, the author listed 2,670 cases of foreign body in the cornea.

The main points to be considered in this connection are (1) proper magnification for the operator so he can see what he is doing and can avoid denuding a large section of the corneal epithelium, and (2) removal of the oxidized tissue which is left after a hot foreign body has been removed. The round dental burrs, fitted into a suitable chuck handle, which can be easily and quickly rotated between the thumb and fingers, are used to remove the oxidized tissue and leave a smooth surface without any undercut edges to harbor bacteria or constantly irritate the eyelid in its passage over the area where the foreign body has been.

Next to foreign bodies the most frequent cause of injury is a burn, either from hot metal, a chemical, or electricity. Quite a number of industries use caustic soda in large quantities in the solid state and in all percentages of the liquid state. Caustic soda burns give no indication that they will always look much worse on the third day than at the time of injury, so that it is essential that remedial measures be taken immediately to neutralize the caustic soda and change it to an inert compound. It has been our custom immediately to apply glycerite of tannin with a cotton applicator. This at once checks the burrowing action of the caustic soda.

Air hose injuries are of special interest, from a diagnostic point of view, in those cases in which emphysema of the conjunctiva is produced. When the hose slips off the nipple the worker does not know that he has been struck by the end of the hose and a possible fracture of the nasal and ethymoid bones has been produced.

When the center of the cornea is involved it is best to cover it with a Van Lint conjunctival flap. In penetrating wounds of the cornea, no repair surgery is attempted until we have had a report from the X-ray laboratory with respect to the presence of a foreign body in the globe.

A case in which a non-magnetic foreign body was removed from within the eyeball is of interest. A lad about 7 years old, with a large piece of copper in the vitreous, was treated by a slight modification of the author's method for the removal of non-magnetic lead shot from the vitreous. In this case the tips of a pair of curved mosquito forceps were inserted into the large wound of entrance made by the copper fragment and, following the directions of the fluoroscopic operator, it was possible to grasp the copper and successfully remove it from the vitreous.

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CONFERENCE ON TEACHING OF SURGERY

GRADUATE AND UNDER-GRADUATE TEACHING OF SURGERY

UNDER the chairmanship of Dr. Ross Millar, an excellent symposium was presented on graduate and undergraduate teaching. The American College of Surgeons is intensely interested in the present day problems of medical teaching, and particularly in studying the best methods of graduate instruction and means of assuring to all surgeons the opportunity for continued advancement in the science of surgery. An abstract of the addresses follows:

TEACHING OF SURGERY

FRED C. ZAPFFE, M.D., Chicago: The spoon feeding method of teaching is wrong. Self-education is the right way to learn, but it must be done under the direction and guidance of a teacher who has prepared a definite course of procedure and who will discuss problems with the student. Reading and conference are the basis of such a course of training. A knowledge of fundamental principles is of first importance. Correlation with every other basic subject in the curriculum, especially the so called basic sciences, is of prime importance and most essential to a proper understanding of surgery. Teachers of all subjects should discuss teaching problems as they affect the whole group; not as they affect the presentation of any one subject.

Teaching of surgery must be done in three departments: undergraduate, graduate, and postgraduate. Undergraduate study should extend through the 4 years of the course. It, alone, will not make a surgeon. A surgeon must be the product of a carefully planned course of graduate study—a course which will justify the licensing of surgeons by state medical examining boards. Postgraduate study is intended for surgeons and others who wish to devote time to planned courses, review courses, or advanced courses extending over short periods of time. Such courses must be given by trained surgeons in a well equipped and well organized institution which is under the direction of a recognized teaching institution.

A committee to study the teaching of surgery in all its phases should be appointed. This committee could prepare a syllabus of study which could serve as a guide to all teachers of surgery.

TEACHING OF SURGERY

ELLIOTT C. CUTLER, M.D., Cleveland, Ohio: The real education of a surgeon is a postgraduate problem since surgery can be learned only by practice. It is necessary, however, that, in their undergraduate training in medical schools, the embryo physicians be taught by the department of surgery something of anæsthesia, so that they may be qualified to give inhalation anæsthetics, and a good deal concerning the care of the ordinary forms of trauma and sepsis since these two latter conditions constitute a large part of the practice of every general practitioner.

To accomplish this purpose it is customary to teach the principles of surgery, which are the methods by which we combat pain, hæmorrhage, and sepsis, at the end of the second year in conjunction with a short course in surgical diagnosis, bandaging, and the use of apparatus. In the third year the students, by a few lectures amplified by clinics and by experience in small groups in outpatient departments, should roughly cover regional surgery and know in what conditions surgery may afford relief Finally, in the fourth year as clinical clerks on the wards of their hospitals, the undergraduates should become even more familiar with the practical art of surgery and learn when and in what conditions it may safely be applied.

MEDICAL EDUCATION

IRVING S. CUTTER, M.D., Chicago, read a paper under the title of "Medical Education."

GRADUATE TEACHING

J. STEWART RODMAN, M.D., Philadelphia: Well qualified specialists in the various fields of medicine are a crying need of the times, even though the specialties are overcrowded—especially in large centers. The reason for this apparent contradiction is that no minimum standard of fitness has been agreed upon by many of the specialties concerned, and the public, therefore, have no means of discriminating between the qualified and poorly trained specialist except by being referred by a physician. There is need for education of the physician and public alike as to the standard which should be exacted of those offering themselves as specialists.

There is no "short cut" to a specialist's training. By what methods can this minimum qualification as a specialist best be secured? Two methods have been suggested, at the end of which preparation the candidate should be required to pass a comprehensive examination conducted by special boards operating under one control. The successful passing by such a board should clearly establish one's fitness to begin the practice of the specialty in question. "Keeping abreast of the times," however, then becomes a large problem for the newly qualified specialist.

The American College of Surgeons fills a real need in this respect. However, attendance at its meetings is not sufficient even for those qualified in the specialties it serves. Supplementary means must be used.

GRADUATE TEACHING OF SURGERY

GEORGE J. HEUER, M.D., Cincinnati, Ohio: The subject is discussed from the viewpoint of the better class of graduate students who are seeking careers in surgery.

An attempt has been made to discover not only opinions as to the work now offered for graduate instruction in surgery but views regarding the sort of graduate instruction wanted. It appears that the chief criticism of the opportunities now available is that they do not permit a comprehensive surgical education but are more in the nature of preparatory courses which, at their completion, leave the graduate student in the position of again having to seek further means of study. It appears that the sort of surgical education being sought is one that will include the opportunity of doing a fairly large amount of operative surgery. It is a question whether it would be possible or desirable to give graduate students the kind of surgical education they want. To do so would require certain adjustments not only in the attitude of many surgical teachers toward graduate teaching but in the arrangement of surgical services in teaching and other hospitals.

GRADUATE TRAINING OF SURGEONS IN THE MAYO FOUNDATION

LOUIS B. WILSON, M.D., director, Rochester, Minnesota: The Mayo Foundation, a part of the Graduate School of the University of Minnesota, has the use of the laboratory, library, museum facilities and the clinical material of the Mayo Clinic. These facilities are adequate in all departments except anatomy, in which graduate work may be done in the Medical School in Minneapolis.

About half of the members of the faculty in laboratory fields are engaged entirely in research, and the remainder partly in research and partly in routine work. In diagnosis, opportunity to study adequate material of great variety is provided in fourteen general diagnostic sections and in twelve special diagnostic sections. More than 1,100 beds are available for surgical patients.

Graduate students are paid small annual stipends as fellows of the University of Minnesota. Twenty to twenty-five are appointed each year on a competitive basis. Young applicants who stood high in the best schools and have had the longest hospital or laboratory training in the best hospitals or laboratories are selected. They come mostly from schools in the United States and Canada, though a few are from foreign countries. They average 27 years of age at the beginning of their residence, and have had an average of about 2 years' graduate training in hospitals. Each fellow elects the work he wishes to do and the person with whom he wishes to do it. The fellows average about 9 months of laboratory work, 15 months of service in diagnostic departments, 1 year of operative second-assisting, and 1 year of operative first-assisting. Their residence is more than 4 years. In order to qualify for the degree of Master of Science in Surgery they must be competent to begin the practice of surgery in a scientific manner without supervision, present an acceptable thesis based on original research work, and pass searching, written and oral examinations. The respect in which graduates of the institution are held in the communities in which they are now practicing warrants the continuation of the present plan.

GRADUATE TEACHING IN SURGERY

GEORGE P. MULLER, M.D., Philadelphia: Criticism of surgical judgment and sometimes of operative technique seems justified after surveying the educational process by which a surgeon is made. Leaving entirely out of consideration those irregular doctors who practice surgery through the aid of fee splitting physicians, it is apparent that surgeons are developed by the simple process of obtaining a hospital connection together with aid of graduate instruction, by being attached for a period of years to a recognized surgeon, or by remaining for a number of years as a full time assistant in surgery in one of the University Medical School Hospitals.

If a proper balance is maintained between research and the clinic, the ideal training for high grade surgery will be found in the university clinics. These men will be the leaders in the future. The great bulk of first class surgery will be done by those men who have been well trained by a surgeon interested in their welfare. In most cases overemphasis is laid upon technique, and the assistant surgeon is not allowed sufficient time to become proficient in the basic sciences. Most of the difficulty lies in the fact that these men sooner or later must make a living and this often interferes with their educational development.

The greatest problem before us is how to educate hospital managers so that more careful appointments to the surgical staff will be made and that men who simply aspire to doing surgery will be kept out until adequate evidence has been offered that they have become proficient in the art of surgery and have been sufficiently trained by an experienced surgeon to have developed judgment. If the schools for graduate instruction, as existing today, would be more discriminating in their selection of students, it is possible that such instruction could be obtained through them by teaching which would be spread over a period of years and not confined, as at present, to a few months or even a year.

CANCER CONFERENCE AND SYMPOSIUM

I. CONFERENCE ON CANCER CLINICS

An abstract of the papers and discussions presented at the Round Table Conference on Cancer Clinics held during the Clinical Congress of the American College of Surgeons in New York, October 15, 1931, is presented in the following pages. Dr. Burton J. Lee, New York, presided.

ADMINISTRATION OF A CANCER CLINIC IN A GENERAL HOSPITAL

CHARLES A. DUKES, M.D., Oakland: For the purposes of illustrating the administration of a cancer clinic in a general hospital, we will use the clinic as developed in the Highland Hospital, a hospital for the care of acute conditions, of 400 beds for the indigent in Alameda County, Oakland, California. The population of this district is about 350,000.

The organization of the visiting staff of this hospital, for administrative purposes, has been divided into two divisions, East and West. These divisions are divided into sections of medicine, surgery, gynecology, and obstetrics, with a chief of each department, and the six chiefs of the visiting staff together with the chiefs of the pathological and radiological departments constitute the active staff of the clinic. The various specialists are called into consultation as cases of interest to them appear. This group was organized by electing a director, an associate director, and a secretary.

The supervisors of this county provided $20,000.00 at the initial organization. This sum permitted the hiring of a full time secretary, a part time radiologist and a part time pathologist on a salary, and also provided for the purpose of equipment for high voltage X-ray and 110 milligrams of radium. Indigent patients are referred to this clinic from the various health centers and clinics of Alameda county, and, by the direction of the director of hospital activities, all cases appearing in the hospital having malignant growths are referred to this clinic for diagnosis and suggestion as to treatment.

During the period of a little over 2 years during which this clinic has existed, more than 2,000 examinations have been made. All of the patients, who number nearly a hundred, who had been in the hospital of Fairmount for the treatment of chronic disease, for various periods of years without active treatment, were treated, classified, and given what comfort was possible. Up to the present time most of the cases have been of the incurable type but it is interesting to note that most of the difficulties of administration have been overcome, that the interest is growing daily in malignant work, and that we are now seeing some cases of the curable type.

REFERENCE OF HOSPITAL PATIENTS TO THE CANCER CLINIC

CHANNING C. SIMMONS, M.D., Boston: The remarks on the reference of hospital patients to the cancer clinic are based on the experience acquired in the formation of the cancer clinic, commonly known as the Tumor Clinic, at the Massachusetts General Hospital.

The head of the clinic should be a senior member of the staff, preferably a surgeon with tact, who should be chosen by them. A hospital is established primarily for the treatment of the sick. It is necessary to prove to the trustees and the staff by the work of its members that the treatment advocated by the clinic gives a larger percentage of cures in the early cases, and a longer span of life in the hopeless cases.

If there is opposition to its formation the clinic may be established purely as a consultation and follow-up clinic. If the opinion of the clinic is not requested or if its recommendations are not carried out by the member of the staff in charge of a case he is open to the criticism by the patient, staff, and trustees, that he is not taking advantage of all the facilities of the hospital and that his patient is not receiving the best advice obtainable in the community. The individual case may be brought up and discussed at the staff meeting.

If the clinic is made a follow-up clinic for all patients with cancer discharged from the hospital, it has another method of checking the work of the individual members of the staff. It is suggested that certain groups of cases be assigned to the clinic for treatment and study with the idea that, after the lapse of a suitable period of time, the clinic shall make a report on this group, giving the treatment advocated and the results, in order to show that the results of such treatment are better than those in similar cases treated by individual members of the staff.

THE RÔLE OF THE SOCIAL SERVICE WORKER IN THE CANCER CLINIC OF A GENERAL HOSPITAL

ELEANOR E. KELLY, Boston: The rôle of a social service worker in a general hospital cancer clinic varies according to the size of the social service department but in the main it is identical with that of the social service worker in every hospital clinic.

In the cancer clinic the fields of responsibility of the social service worker embrace the facilitation of early diagnosis and treatment, following up patients after treatment, and collecting and interpreting social data of significance.

When the diagnosis of cancer is made, the social service worker helps to remove all obstacles in the way of the patient's carrying out the recommendations for treatment, and this is the most important work. The psychological aspect of the patient's problem is the serious and immediate concern of the social service worker. She discusses plans and resources with each new patient and helps him to work out a solution for himself, which must include consideration of his family and his economic situation, and religious and racial prejudices and superstitions. It should be the social service worker's responsibility to see that the patient is definitely referred to the proper clinic or hospital or back to his own doctor, and to interpret his medical problem to his family and to those who may be directly interested in his social welfare, so that last but not least, the social worker is contributing her share to the educational program in the control of cancer.

CHARACTER OF CONFERENCES OF THE CANCER CLINIC STAFF

EDWARD J. KLOPP, M.D., Philadelphia: The organization of a cancer clinic in a general hospital in a large city should consist of a surgeon, a pathologist, a roentgenologist, a radium therapist, an electrotherapeutist, an internist, a gynecologist, a dermatologist, a urologist, a bronchoscopist, an otolaryngologist, a chemist, a chief of clinic, a stenographer, a technician, and, if possible, a social service worker.

Meetings should be held weekly at which new cases should be studied and old cases reviewed. The method of study and investigation and plan of treatment is decided upon by a group. A report of all cases presented should be sent to every one directly interested in the clinic. Records should be kept in accordance with the approved blanks of the American College of Surgeons. The chief of clinic should be responsible for the records.

Advantages of cancer clinics to patients: The patient receives careful consideration, good advice, and the best treatment the hospital or the community affords. The popularity of the clinic has a tendency to divert patients from cultists and charlatans.

Advantages to physicians interested in the clinic: The individual physician will see a larger variety of tumors, and the opinions of others will give him valuable information. Every physician, regardless of his special work, will see the results obtained by other men. Many surgeons know little about the response of certain tumors to irradiation. The radiologist has an opportunity to see tumors before operation. The pathologist has the privilege of seeing the tumor in mother soil. His suggestions are of the utmost value. A group of physicians see a number of patients in a systematic manner with all records at hand during the clinic hour, thus saving time.

IMPORTANCE OF NOMENCLATURE IN CANCER CLINICS

WILLIAM CARPENTER MACCARTY, M.D., Rochester, Minnesota. The discussion of the "Importance of Nomenclature in Cancer Clinics" appears in full on pages 317-328 of this issue.

RADIUM CONTAINERS AND THE CUSTODY OF RADIUM

EDWIN C. ERNST, M.D., St. Louis: The use of radium in a general hospital may be subjected to many abuses, unless such an application is under the control of an experienced physician or the administration of radium is limited to a small group of surgeons who have received the proper technical training and have had the necessary practical experience in radiation therapy. The promiscuous use of radium by inexperienced members of any hospital staff is to be deplored if the best interests of the patient are of primary consideration. The question of proper radium containers is a highly technical physical problem. The importance of the protection of the patient, the doctor, and his coworkers from the rays of radium are equally emphasized throughout this discussion. The recommendations of the International Congress of Radiology with reference to the minimum radium protection standards are discussed with respect to the possible undesirable effects upon the radium workers in charge of this type of therapy.

THE UNIFORMITY OF CANCER CLINIC RECORDS

LOUIS I. DUBLIN, Ph.D., New York: Medicine and surgery have long needed effective, economical records and follow-up systems whereby methods of treatment and end-results could be determined and evaluated. And this need is especially apparent in the field of cancer diagnosis and treatment, where determination of the end-results of treatment is conditioned by precision and completeness of clinical observation and by time and patience in the follow-up. A record and follow-up system for cancer cases must be uniform for the several agencies in the field in order to secure an adequate base for cancer observation and so that experience may be combined with the least expense and the greatest general utility. Uniformity in respect to the following features of the record is essential to the further and more productive study of case experience: (I) The general record of the patient in respect to social and economic status, personal and family history and of those many factors of bodily economy which may, some day, be deemed significant in the chain of circumstances leading to malignant new-growths. (II) A special record according to each major site for the carcinomata, with further and special details regarding the patient's occupational or domestic life or history which seem to have a bearing on the carcinoma of the site under treatment. (III) A special

record of other types of new-growth (sarcoma, by site) if a sufficient volume of material is in sight.

Practical problems on the administrative side in drafting and applying the forms for general cancer clinic work seem to be: (1) adaptation of the cancer record system to the pattern of the hospital record system as a whole; (2) arrangements for merging the clinic record with the laboratory and bedside record, if hospital treatment is later deemed to be advisable; (3) linking the clinic and bedside record with social service and other follow-up facilities.

On the mechanical side there is to be considered the size of the record form, the arrangement of the items for the best use of the recorder, and later for the statistician, the exact content, the ordering and the materiality of the items of information to be recorded. At all times there must be kept in mind the ultimate uses of the record forms. A record system of the most efficient and academically correct type must lend itself to the facilities for analysis which existing funds and analytical personnel warrant.

VALUE OF DIAGNOSTIC CANCER CLINICS

BURTON J. LEE, M.D., New York: The first basic idea behind the organization of cancer diagnostic clinics is the appreciation that a group judgment is essential if an accurate diagnosis of the patient's condition is to be attained. The cancer diagnostic clinics which are being organized by the American College of Surgeons have as one of the basic ideas the necessity for the bulking of cancer material in any community so that all the men of that community may see the material and become familiar with the various phases of cancer. With such a plan, each medical man in the community is enabled to see in a large measure the cancer material which comes under the observation of all of his professional confreres.

Such a movement, therefore, becomes an extremely important educational one from two standpoints; the first and most important, the education of the medical man in any community in the matter of more searching diagnosis in cancer patients, and, second, the education of the public itself who are coming to appreciate that no one man's judgment in this field must necessarily be considered final.

The cancer diagnostic clinic is built around the weekly cancer conference and this is the most important activity of such a clinic. Here men in all branches of the profession may meet, observe, study, and diagnose the patients presented before them for consideration.

The cancer diagnostic clinic is proposed as an educational project in behalf of the medical profession of the community in which it is established. Cancerous disease in all its phases may be presented at such a clinic, and it is well for us to remember that the whole field of cancer is a far wider one than general medicine itself. Medical education may begin in the medical schools of our country but no doctor's medical education is ever complete, and a cancer diagnostic clinic constitutes an effective method for educating the doctor. At such a conference interesting pathological material may also be shown and no doctor need be persuaded that the proper presentation of pathological material upon cancerous patients will not add valuable knowledge to the subject. If the community in which the cancer diagnostic clinic is organized has no facilities for adequate therapeutic use of radium and roentgen-rays, such a conference, according to the plan of the College, is expected to refer these patients to centers where adequate treatment may be provided.

As this program in behalf of better service for the cancer patient progresses, many of the larger communities in which cancer diagnostic clinics are organized will demand that adequate therapeutic facilities be added and "proper therapeutic facilities" mean not only an adequate supply of radium and modern X-ray equipment, but men trained in the use of these agents to apply them with the proper technique and without menace to the patient to be treated. The cancer diagnostic clinic, therefore, is the first step in any community toward better care for the cancer patient.

II. CANCER SYMPOSIUM

AN abstract of the papers and discussions presented at the Cancer Symposium held during the Clinical Congress of the American College of Surgeons in New York, October 15, 1931, is presented in the following pages. Dr. Robert B. Greenough, Boston, presided.

REPORT OF THE COMMITTEE ON THE TREATMENT OF MALIGNANT DISEASES

ROBERT B. GREENOUGH, M.D., Chairman, Boston, presented a report of the Committee on the Treatment of Malignant Diseases which is published elsewhere in this issue (see p. 440).

THE RÔLE OF EDUCATION IN THE CANCER CAMPAIGN

CLARENCE C. LITTLE, Sc.D., New York: Contacts made with the medical profession and with the laity by the regional field representatives of the American Society for the Control of Cancer have brought out several facts concerning the educational program needed in the field of cancer.

1. The types of education needed are diversified according to the nature of the individual and thus require not only advice as to symptomatology and therapy of different types but on sociological, economic, and political subjects as well.

2. The educational needs are diversified according to whether they involve the profession, the laity, or both. Since the profession tends to specialize, it is desirable that the general phases of the educational program in the field of cancer be handled by those who are not themselves specialists in any one particular phase of medicine.

3. The types of education needed vary under local conditions and thus cannot be met by a general or comprehensive long distance treatment.

4. The types of education needed must be correlated in order to prevent over-balancing or under-emphasis as the case may be.

5. The situation often demands education against certain existing menaces as well as the construction of new types of behavior by the laity.

6. The educational problem is often non-technical and therefore requires the study and advice of a group of field representatives which is composed not of highly technical experts but of men whose training is especially designed to give them sympathetic rather than professional contacts with lay groups.

7. The educational processes often are of the nature of public health problems thus requiring the type of field representative who can deal with health officers and the various unavoidable political aspects of the situation.

It will thus be seen that cancer is a problem requiring a well balanced and continuous organization to handle its various phases. Education must be planned to meet the training of the people affected and the local conditions, and to urge the non-partisan presentation of conservative information.

PLAN OF RADIOLOGICAL WORK AT CALIFORNIA INSTITUTE OF TECHNOLOGY

SEELEY G. MUDD, M.D., and CHARLES C. LAURITSEN, Ph.D., Pasadena: For some time radiologists have recognized the desirability of investigating the clinical effects of extremely hard X-rays in the treatment of deep seated malignant tumors. Inasmuch as apparatus for generating X-rays of this type had been in use at the California Institute for Physical Research, it was deemed desirable to use this equipment for clinical purposes. A brief description of the equipment now in use is included. Reference is made to the installation at the new W. K. Kellogg Radiation Laboratory which is expected to be finished at the end of the year. The operating conditions have been maintained constant for all of the therapeutic work and are as follows: tube potential 550,000 volts peak, tube current 4 milliamperes, filter 6 millimeters steel, 1 millimeter aluminum, and 8 millimeters felt, target skin distance 50 centimeters. Under these conditions the output, measured with the free air chamber, is 20 roentgens per minute.

The medical work is directed by a Medical Advisory Board, appointed by the Institute. During the past 9 months 85 persons showing evidence of inoperable malignant growths, without general metastasis, have been treated. The erythema dose is 900 roentgens. No alarming systemic reactions have been observed. Obviously sufficient time has not elapsed to permit discussion of results. It is contemplated to restrict the groups of patients treated and study more intensively malignant tumors of the rectum, larynx, œsophagus, and breast. During the past few months studies have been carried out on rats, comparing the effects of X-rays at potentials of 200,000 and 550,000 volts.

NEWER DEVELOPMENTS IN X-RAY THERAPY OF CANCER

RALPH H. HERENDEEN, M.D., New York, presented a discussion of the "Newer Developments in X-ray Therapy of Cancer" (see p. 329).

THE VALUE OF RADIATION IN THE TREATMENT OF BREAST CARCINOMA

SIR GEORGE LENTHAL CHEATLE, K.C.B., C.V.O., F.R.C.S., London: On account of its relative radio-resistance, I have been treating mammary carcinoma by means of interstitial radiation. By this means I have exposed six breasts and the axillæ of the corresponding sides to 18,000 milligram hours extended over 8 days. I have examined microscopically whole sections of the entire parts removed, 5 of them 6 months and 1 of them 18 months after this treatment, with the following results:

In the first 5 cases, all showed what appeared to be complete regression clinically, and I discovered that most of the disease had been put out of action. However, they all contained some carcinoma cells which looked to be active, viable, and potential sources of future extension of the disease. Therefore, three factors should be borne in mind:

1. These particular cells may have been untouched by the treatment.

2. If they were untouched, the bed in which they existed may have been rendered incapable of supporting or allowing their further activity and that therefore they may eventually die.

3. The question as to whether these viable looking cells are biologically as active as they look.

In the sixth case I could not discover any active looking carcinoma cells at all. Such a result suggests that if eighteen months had elapsed in the 5 cases mentioned instead of only 6 months, they might also have shown the same efficient result as the sixth case. I do not know. And because I do not know, my present opinion is that it is safer to remove by surgical operation all breast carcinomata that are presumably clinically operable.

After this operation I externally radiate the whole area of the side of the thorax from which the diseased area has been removed. I adopt this partly empirical plan in the hope that if there be any carcinoma cells left which are amenable to external radiation they will be destroyed.

As a rule I do not submit a presumably clinically operable tumor to a preliminary external radiation. I admit that by so doing it might be proved whether or not the tumor in question is exceptionally radio-

sensitive, and thus the question might arise as to whether any surgical procedure would be indicated. But the fact remains that most of these tumors are relatively radioresistant; therefore, as a general rule invaluable time would be wasted by postponing a radical removal of the disease.

THE PRESENT STATUS OF MALIGNANT DISEASES OF THE STOMACH

DONALD C. BALFOUR, M.D., Rochester, Minnesota: The fact that cancer of the stomach can be cured by removal of the local growth and regional lymph nodes has not been given sufficient prominence. Many cases have been reported of patients who have lived their normal expectation of life following removal of such lesions. Although statistics show a gradual increase in the rate of operability, yet the great problem remains the same: namely, early recognition of the disease and prompt operation.

Pessimism with regard to cancer of the stomach is common, both among the laity and the medical profession. A trend away from this attitude is apparent, due to the intensive educational campaigns to inform the public of the facts in regard to cancer. Such education should not be confined to the laity, as often physicians are so pessimistic in their attitude toward cancer that the patient finds little encouragement for the only program which offers him any help.

One of the problems of cancer of the stomach is its relation to chronic ulcer. Failure to distinguish with certainty between chronic gastric ulcer and early cancer has been the doom of many patients.

Another obstacle in the treatment of cancer of the stomach is the risk of operation. This obstacle, however, is not so great as has been supposed, for it is shown that partial gastrectomy for cancer of the stomach can be done with a mortality rate of 10 per cent or less. Pre-operative preparations, anæsthetic, type of operation, and after-care should be emphasized.

The author is convinced that treatment of cancer of the stomach will become more and more efficient. Five-year cures can be obtained in 50 per cent of cases in which the lymph nodes are not involved, and the records of the Mayo Clinic show 278 5-year cures following resection for cancer of the stomach. From the standpoint of palliation, surgery can offer much to the patient with cancer of the stomach. These facts should be constantly reiterated to both the laity and to the profession.

CONFERENCE ON TRAUMATIC SURGERY

INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

AN abstract of the papers presented before the Conference on Industrial Medicine and Traumatic Surgery follows. Dr. Frederic A. Besley, chairman, presided.

A SURVEY OF THE FIELD OF INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

FREDERIC A. BESLEY, M.D., Waukegan, Illinois: The desirability of rendering more scientific, adequate, and effective treatment to the sick and injured in industry and, thereby, limiting the enormous human wastage, admits of no argument from a humanitarian viewpoint. Fortunately, it is no less desirable from an economic and financial consideration, and gradually, but surely, the leaders in industry are coming to understand this phase of the situation. The work of this Board on Industrial Medicine and Traumatic Surgery has been in progress for 5 years and, like all new educational movements, it has had many vicissitudes.

During the past year the work has received a new impetus through the keen vision and guiding influence of our Director-General, Doctor Franklin H. Martin. He has assumed a most active interest and has placed in the field two excellent, highly trained men, Dr. Williamson and Dr. Newquist, who have made a careful study and a detailed survey of some of the larger industrial clinics and the methods of these industries in the care of their ill and injured.

As a basis of this study the minimum standard for industrial clinics, as established by this Board, has been used. (See p. 441 for terms of minimum standard.) Up to the present time, 174 clinics have been visited and of them 84 have been approved as fulfilling the requirements of this minimum standard. The number of facts, figures, and the amount of educational material these men in the field have accumulated is enormous, and their reactions, deductions, and reports are most enlightening. Their work will go far in aiding the authorities of the American College of Surgeons in developing this new department of activity with background and intelligence. One outstanding observation that has been made is the lack of appreciation on the part of industrial executives of the enormous possibilities for economic gain if their employees are kept fit or, if injured or sick, are restored to an earning capacity in the shortest possible time known to scientists and experienced physicians and surgeons.

Statistics are being accumulated that will show beyond any reasonable doubt that, if intelligent medical organization with authority can be inducted into the health welfare of the workers in industry, there will be a financial saving of millions of dollars yearly. Mr. Walter E. Carr has done a constructive piece of work in the analysis of this phase of the situation.

You are all familiar with what happened to the soldiers in the army previous to the late World War. Typhoid, dysentery, tetanus, and gangrene were rampant and caused far more deaths than did bullets. It can be stated in all fairness that until the late war the higher staff officers and executives were prone to regard their medical departments as necessary evils that were tolerated but rarely consulted regarding the health and welfare of the troops. The staff was self-sufficient.

All of this was changed in the late war and the transformation occurred as a result of an understanding on the part of the statesmen and higher staff officers that it was necessary to consider all the circumstances surrounding the health and welfare of the men in the ranks if they hoped to secure and maintain an army with a high morale, great loyalty, efficiency, and effectiveness in the field. As a result of this understanding, it was immediately recognized that this accomplishment would be possible only if a staff of medical men with scientific training and practical experience were given sufficient authority to execute a well-made plan. The authority was granted. It is not necessary to elucidate the beneficial effects of the splendid medical organization whose counsel and advice were accepted and acted upon.

Is there an analogous situation existing in industry at the present time? It is believed that there is. Think what would have happened and the chaos that would exist now if *no* pre-enlistment examinations had been made. How many complications and embarrassments will a carefully made and recorded pre-employment health audit save the employer? This audit protects, also, the best interests of the worker. Some of these questions the American College of Surgeons will be in a position to answer intelligently and correctly because of its intensive study of the circumstances and conditions connected with this large subject. The lack of comprehension and appreciation of the importance of this subject of health and welfare of employees on the part of industrial executives is natural. It is due, at least in part, to the failure of the medical profession to indulge in a larger program of education. Wise men know that, in this rapidly changing and incalculable

world, it is unsafe to make positive prophecies and predictions. Yet we do have beliefs and convictions, and it is our opinion and belief that the type of men which constitutes the membership of the American College of Surgeons is capable and will bring order out of the present chaos.

This prophecy is made advisedly, knowing full well that time, and not authority, will determine its truth.

SURGERY CLINIC IN SMALL INDUSTRIES

HART E. FISHER, M.D., Chicago, prepared a paper, on this subject but he was absent and the article was not read.

VALUE OF ETHYLENE IN TRAUMATIC SURGERY

DONALD GUTHRIE, M.D., Sayre, Pennsylvania: The importance of having a competent anæsthetist whenever surgical procedures are performed cannot be overemphasized. In traumatic surgery the responsibility of the anæsthetist is second only to that of the surgeon, for the administration of an anæsthetic to a seriously injured person may be the deciding factor in the outcome of the case. Close cooperation and complete understanding of the difficulties attending this phase of an operation should exist between surgeon and anæsthetist.

Chloroform as an anæsthetic has been practically abandoned, for its dangers are well known. Ether no longer is considered the ideal anæsthetic and is not now generally used. Where ether has been discontinued, gas, ethylene and oxygen, or spinal anæsthesia are usually employed. In our clinic we were impressed with the use of nitrous oxide and oxygen until we learned its dangers and limitations. Since 1927, we have used ethylene routinely.

Those who employ ethylene extensively agree with Gwathmey that the margin of safety afforded by it is greater than that of chloroform, nitrous oxide, nitrous oxide and ether, or ether alone. Respiration under ethylene is quiet, not labored, and resembles that of normal sleep; the patient's color is pink, and the pores of the skin remain closed and the skin is dry; thus there is no loss of fluid volume.

I believe that ethylene is the ideal anæsthetic in traumatic surgery because its use does not affect the bodily fluid volume and alkali reserve if properly given blood pressure is maintained and mucous secretion is not stimulated, so that the incidence of postoperative chest complications is reduced.

The disadvantages of ethylene are (1) the inability of some surgeons to obtain the necessary amount of relaxation, (2) its supposed tendency to increase oozing, (3) its effect on blood pressure, (4) its explosiveness.

We have successfully combated all these disadvantages in our experience in over 15,500 administrations of ethylene in our clinic.

THE IMPORTANCE OF THE FOLLOW-UP CLINIC

GROVER C. PENBERTHY, M.D., F.A.C.S., Detroit, Michigan: The follow-up clinic affords information as to what constitutes the average favorable clinical result in a given morbid condition. It also permits an accurate estimate of the disability in serious physical injury. It identifies the more marked sequelæ and indicates measures for preventing them. It furnishes a correlation of the end-results following the different methods of treatment of the injured, and evaluates the therapeutic measures employed in acute conditions; it discloses the causes of failures. This, in turn, develops prognostic ability which is often of greater importance to the patient than the average diagnosis or treatment. It is a contribution of inestimable value to medical knowledge—a contribution which should be the primary motive of the follow-up clinic. Preventive medicine, naturally, could not, in all its phases, be successfully applied without a careful study and analysis of such information as is gained through the follow-up clinic.

A complete history, including physical and routine laboratory examination, is required in all well organized clinics and, in addition in the surgical case, operative findings and postoperative notes are recorded. To complete this story the study and recording of residual clinical findings should be an important part in each case record.

The clinical organization of the follow-up should be dependent upon the kind of disability. The more local the condition the simpler the follow-up problem. The generalized condition develops a more complex problem and necessitates organized effort. The follow-up clinic is indicative of a healthy trend in medical practice and should be considered just as important as a diagnostic or general clinic. There is great necessity for reviewing, qualifying, and evaluating the knowledge now available.

UNILATERAL FRACTURES OF THE CONDYLES OF THE FEMUR AND UNILATERAL FRACTURES OF THE TUBEROSITIES OF THE TIBIA

WILLIAM R. CUBBINS, M.D., F.A.C.S., ARTHUR H. CONLEY, M.D., JAMES J. CALLAHAN, M.D., and CARLO S. SCUDERI, M.D., Chicago, Illinois: Automobile and aviation accidents are causing a marked increase in the number of injuries around the knee joint. The most characteristic injury of this type is fracture of the lateral tuberosity of the tibia. This fracture may consist of a splitting off of the lateral half of the tuberosity, with a dislocation of the meniscus downward between the fragments. The next most common injury is that in which the lateral tuberosity is crushed downward, either in its entirety, or in the anterior or posterior portion of its weight bearing surface, in such a manner that the lateral meniscus is detached from its lateral attachments and allowed to hang free in the joint, or is fractured and torn at the time of the injury.

We have attempted to repair these injuries with open operations in which the meniscus was removed, the bone fragments reconstructed with suture or screws, or with fragments of bone obtained from the tibial crest, the method being determined by the conditions encountered at the time of operation.

The differences between injuries to the medial tuberosity and the lateral tuberosity are emphasized. The lateral tuberosity is fractured in 9 out of 10 cases. The medial tuberosity is dislocated backward and downward, instead of being crushed as is so common with the lateral.

In unilateral fractures of the condyles, it is difficult to hold the fragments in position with traction or casts, owing to the fact that the gastrocnemius causes a rotation backward and downward. These have been corrected with metal screws, as they are more easily applied and because the large thread holds more firmly than bone or ivory screws. With loose closure of the joint, extravasation of the fluid contents aids in keeping the joint cavity clean.

SOME METHODS OF REDUCING INDUSTRIAL ACCIDENT SEVERITY

J. J. WITTMER, M.D., New York: The medical factors in the reduction of severity of industrial accidents are as follows:

1. The examination of all new employees. Our experience has demonstrated that all persons considered for employment, regardless of the work they expect to do, should have thorough physical examinations. A definite physical standard should be set up for each type of job. In this way employes will not be a hazard in any particular kind of work and, at the same time, will be stronger and healthier after many years of labor.

2. The re-examination of all employes at definite intervals. Physical check-up of all employes often reveals incipient degenerative conditions, aggravation of minor physical defects, inability to stand the strain of certain kinds of work, or mental inertia due to prolonged routine, monotonous, daily regimen.

3. The provision of adequate first aid treatment immediately after an accident has occurred, so that the injury received shall not be increased in severity.

4. First aid education. It is my firm conviction that adequate first aid cannot be rendered in accident cases unless all employees are instructed how to use the material furnished, why it should be used in the manner specified, and unless an adequate and constantly maintained supply of the material provided is accessible to each employee, whatever his duties may be, or wherever they may carry him.

5. Adequate and painstaking medical treatment and control of the case throughout the period of complete and partial disability of the patient. It is essential, if a doctor is to be successful in traumatic work that he look at each injury as an analyst, as a scientist, as a lawyer, and as a business man.

6. Complete rehabilitation of the patient so far as is possible, by proper reconstructive treatment to minimize the loss or deformity to as great a degree as medical science at present permits. The doctor must keep in mind that the severity of the accident depends upon the outcome of the injury. Usually the result is very greatly affected by the nature of the treatment and a great responsibility therefore lies upon the doctor. Severity is gauged by the time lost from work and the extent of the deformity. A vast amount of lost time can be saved and inestimable good done by intelligent and persevering care from the moment the injury occurs until it is finally cleared up. We have reason to believe that such procedures are justified because of the following results:

1. The reduction of severity, i.e., fatalities lessened, lost time reduced for all types of injuries.

2. A very low incidence of infection.

3. The very considerable reduction of compensation awards for deformities and permanent partial disabilities.

4. The improved morale of the working forces due to their knowledge of the genuine interest and efficient care taken of them by their company.

5. The increased working ability of the men in the field through their being kept as nearly as possible in first class physical condition.

SPONDYLOLISTHESIS

HENRY W. MEYERDING, M.D., Rochester, Minnesota, discussed the subject of "Spondylolisthesis" (see p. 371).

LOCAL ANÆSTHESIA AS A FACTOR IN REDUCING THE MORBIDITY OF TRAUMATIC SURGERY

LT.-COM. MORTON WILLCUTTS, Great Lakes Illinois, discussed the use of "Local Anæsthesia as a Factor in Reducing the Morbidity of Traumatic Surgery" (see p. 378).

THE ADVISABILITY OF THE EARLY RETURN TO WORK OF THE INJURED

WILLIAM L. ESTES, JR., M.D., and L. A. SHOUDY, M.D., Bethlehem, Pennsylvania: Wisely has it been said that the *tyro* in medicine treats the disease and not the patient, but that to *cure* patients we must treat the *patient* together with the disease. So with the injured; too often interest in the injury or the type of fracture, in methods of reduction, maintenance of reduction, and return of function, etc., is the absorbing problem, and the injured man himself—his reaction to his injury—is neglected. In severe injuries with prolonged disability, the injured man easily becomes discouraged with respect to the early use of the disabled part; he develops an inferiority complex, as it were, toward any work or job, an attitude that is quite abnormal. He may be worried by physical therapy and not understand it, or have difficulty in co-operating in the use of, unusual or unfamiliar methods to regain function, since his attention is focused constantly on the disability which persists and which must be overcome.

If, however, after *some* function has been restored in the injured part, he can be put on a job, or back on his old job, preferably in the same environment or in the same shop where he worked before, his mind is again concentrated on work to be done, he realizes he is still good for something, and in the distraction—incidental to this work or job—of his thought from his injury, he subconsciously or unwittingly uses the disabled member by normal or natu-

ral movements incident to work, and obtains quicker recovery of complete function than by simple detached physical therapy. Whenever necessary, however, massage and mechano-therapy can also be continued even though the injured man has resumed work. In other words, occupation therapy is substituted for an abnormal or unfamiliar occupational or physical therapy.

To accomplish this requires close co-operation between the surgeon in charge, the director of physical therapy, the company surgeon, and the superintendent or foreman of the shop where the injured man is employed. The superintendent or foreman, or both, must be "sold on the idea." Often the aid of fellow workmen must be enlisted to encourage the injured man to help him pick up the threads of his new or old job and to regain confidence in his ability to carry on.

Each individual case must be decided on its own merits. The early return to work and earning power of the injured is an asset to: (1) the injured man himself; (2) the industry; (3) the employer—labor relations.

THE PREVENTION OF SHOCK AND TRAUMA DURING THE TRANSPORTATION OF TRAUMATIC SURGICAL CASES BY FIXED TRACTION SPLINTING

WILLIAM L. KELLER, M.D., Washington, District of Columbia: With the motorizing of a great proportion of our vehicles of transportation, the proportion of traumatic surgery has increased, especially major fractures of the extremities, and since shock and trauma are often such important factors in the mortality of traumatic surgery, every effort should be made to eliminate these factors.

Many of our present transportation splints are cumbersome to such a degree that it is difficult to transport the splinted patient, except by ambulance, and since ambulances are not always available and automobiles are usually accessible, it is important that the splints should not add to our difficulties. They are often so difficult to apply that trauma incident to application is often greater than if the splinting were omitted. Splints for transportation should be light and never cumbersome, and of such design as to permit easy application. The standard Thomas splint, which is admirable for treatment in hospital, is not always best for transportation, as the rings are often too small or too large and cannot be replaced in an emergency far from the source of supply. They do not rest against the tuberosity of the ischium, and consequently are worthless as far as traction is concerned.

For all major fractures of the lower extremity the army hinged half ring is admirable. It is easily applied by slipping it into position from the side, without pain or trauma. For all major fractures of the upper extremity, the Murray hinged Thomas arm splint, slightly modified to permit its application from the side, is ideal, as the hinge permits the arm to be placed in any position and still maintain traction.

All injuries of the extremities requiring transportation should be treated as potential fractures and splinted at once with minimum handling. Open wounds should be temporarily treated with an emergency protective dressing without hand contact. On completion of transportation, splints can be replaced or removed permanently, depending on the findings at examination.

INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

FRANKLIN H. MARTIN, M.D., Director-General: A going organization may be proud to attract the co-ordinated group of followers and promoters who are participating in this meeting on industrial medicine and traumatic surgery.

Why? Because an organization that is created to keep employees and officials well and to care for these employees and officials when they are ill, must have the enthusiastic support of the men who practice medicine and surgery. It must have the co-operative support of the employees, including the men and women who work with their hands. It must have the enthusiastic support of the indemnity and insurance companies, and, finally, it must have the enthusiastic support of those who make and administer our laws.

And in this symposium today we have on our platform the leaders of each of these groups: medical men familiar with the requirements of industry; employers representing our important industries; employees represented by influential labor leaders; officials of the leading indemnity companies, and an ex-Governor of this great commonwealth of New York, who with his marvelous administrative foresight, while serving the State, prepared one of the most illuminating documents on the problems of industrial medicine that has ever been written.

During all these years, the health and living conditions of the great body of employees had not been fully protected because of differences between the representatives of these various groups. They have now gotten together and are co-operating, and thereby conserving health and happiness, and bringing about untold economic savings.

I have been flattered by the reports which have been sent to the American College of Surgeons. The College, with its 10,000 Fellows, has furnished a disinterested leadership that is respected by the human elements in this problem.

Flattered by this compliment, and realizing that the College has had more than a little influence in bringing about this better co-operation, I cannot forget that better business has come to realize the economic value of the honest care of the people; the people are recognizing the value of these efforts; the profession of medicine has awakened to the value of these efforts, and has divorced the service from the stigma of cheap contract and insurance practice; and, finally, the states have taken a strong hand in regulating this problem of great business.

A recent annual report indicated that the casualties in this country, among workers in industry,

numbered 19,000 killed, and 2,500,000 lost time injuries without death. Approximately 32,500 were killed, and over 1,000,000 were injured in automobile accidents.

Hence it is no longer a hit or miss problem, but one of the substantial programs that marks the march of civilization, in which the American College of Surgeons is proud to be known as one of the factors, and in which it furnishes a progressive, disinterested yearly audit based on a true standard and backed by actual surveys. As the Director-General of the American College of Surgeons and as its official representative, I wish to express the appreciation of my associates for the generous response of our guests to our invitation, and for their efforts in behalf of this program, in which our organization is so vitally interested.

THE INDUSTRIAL ACCIDENT CASE

WILLIAM R. MCCLURE, M.D., Detroit: In the problem of the industrial accident case, the question of prevention is already being well studied and handled by safety departments in most of our industries. It is simply a business proposition.

In regard to treatment, the lessons learned in the World War in controlling infection are far too important to be forgotten. The first of these was the great importance of complete surgical care at the earliest possible moment. Application of this lesson to our problem is best made by increasing the numbers of industrial hospitals. These need not be elaborate. Our mobile surgical units in the World War carried out major surgery with equipment easily loaded on a few trucks. Industrial hospitals so equipped would allow quicker surgical attention than can be obtained by sending the injured to some outside hospital.

The second lesson of the World War was the necessity of a special technique of surgical procedure in caring for traumatized and infected tissue. This brings up the need for specially trained industrial surgeons. Medical schools alone cannot go far in training these men. The hearty co-operation of the industrialist is necessary. When the industrialist recognizes the value of the trained industrial surgeon and will pay accordingly for his services, then medical graduates will be willing to take supplementary training in the larger industrial hospitals. The work of such specially trained men working in special industrial hospitals will do much to improve the lot of the industrial accident case. If these men later go into private work they will be a great asset on the staff of community hospitals in the care of patients suffering from accidents received in the street or home, or in industrial plants too small to maintain a medical department.

ECONOMIC READJUSTMENT FOLLOWING HEAD INJURIES

TEMPLE FAY, M.D., Philadelphia, discussed Economic Readjustment Following Head Injuries (see p. 362).

ATTITUDE OF THE RAILROADS TOWARD THE PROGRAM OF THE AMERICAN COLLEGE OF SURGEONS IN INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

HARVEY BARTLE, M.D., Chief Medical Examiner, Pennsylvania Railroad: The Pennsylvania Railroad has for some time emphasized measures for the prevention of accidents; for the most improved service in the treatment of accident cases to prevent extensive economic loss to the employee as well as interruption in production and service; and lastly, for reconstructive surgery and placement of those who have become disqualified for regular service as the result of accidents.

We fully appreciate the importance of a collective expression in the traumatic surgery program. The American College of Surgeons is the organization that should take the initiative in such a problem necessary to secure the desired results. The Herculean character of the task should not deter industry from making an aggressive approach to the problem and with the assistance of the latest scientific developments attempt quickly to restore the injured to usefulness.

1. *First Aid.* We have carried on for years a program of first aid instruction to selected individuals in shops, and track gangs, to station employees, and train service men. This includes, in addition to first aid, instruction in resuscitation from electric shock.

2. *Transportation.* The major portion of our traumatic cases occur in shops or local centers and are cared for by our local surgeons or transported to hospitals in ambulances. There are, however, some who are taken on trains to distant points. The correct way of handling injured persons is covered in our first aid instruction to employees. We believe it is impractical, unwise, and a useless expenditure of money to carry on trains a lot of accessory equipment for the handling of injured persons. Our aim is to keep such apparatus and equipment at a minimum compatible with proper service.

3. *Co-operation.* (1) The need of standardization is apparent for the classification of injuries in terms generally understood: (a) There should be uniform methods of diagnoses including X-ray and serological tests; (b) The most improved apparatus should be recognized and used; (c) The follow-up treatment is essential and should receive the most serious attention; (d) There should be a clearing house for all reports of accidents occurring on duty to consider cause, extent of trauma, progress, check by X-ray from time to time, if necessary, and reference to consultants when advisable. (2) The latest information available on the proper and improved method of handling traumatic cases should be generally disseminated to all members of the surgical staff. We attempt to use hospitals on the approved list. (3) While we endeavor to prevent results as far as possible that will require reconstructive surgery, cases do occur and we immediately refer them to

consultants of national reputation in plastic, bone, and neuro-surgery.

We stand ready to participate in a practical manner with a program developed by the American College of Surgeons. I wish to thank the American College of Surgeons for the privilege of speaking for the Pennsylvania Railroad on this subject.

LABOR'S INTEREST IN INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

EDWARD F. MCGRADY, Representative, American Federation of Labor: The subject we are discussing today is of increasing importance to the working man. A half century ago, many of our manufacturing processes depended largely on the work of the human hand; today power machinery has taken over thousands of processes which formerly depended upon human skill. With this change comes the risk of accident from heat, relentless wheels revolving at terrific speed, fast moving belts, and the dangers of molten metal and boiling chemicals. Today cigars are rolled by machine, glass bottles are blown by machine, giant machines stamp out whole automobile frames, or roll out strip steel by the mile.

These new processes take a heavy toll of life and limb. Accident statistics show us that the death rate from accident in industry is nearly twice that for all other accidents which may befall an individual. In 1929, the accidental death rate per 100,000 in industry was 99, from all other causes including automobile accidents, 57. It is estimated that 3,000,000 industrial accidents occur each year, 24,000 of which are fatal. Loss of work time from the yearly toll of serious permanent disabilities has been estimated at 350,000 man-years, while the less serious injuries probably cause a loss of 3,000,000 weeks' work per year.

Cold figures show the huge danger the worker faces, but they cannot tell what it means to thousands of families when the breadwinner fails to come home or when he comes home permanently disabled. Losses of only a month or a week take heavy toll in suffering and anxiety, to say nothing of the expense for medical care and the loss of wages which must be taken from food, clothing, or some equally essential item in the family budget.

One worker in every 14 suffers an industrial accident of some sort during the year. This means that over a period of 15 years hardly a single worker in industry will escape at least a minor accident.

Because of this risk which every worker must assume as he enters industry, labor is vitally interested in your program to lay the foundation for closer co-operation between the members of your profession and those who need your services. If the worker may have recourse at once to the medical and surgical care he needs at the time of the accident, hundreds of lives may be saved and thousands of small injuries may be prevented from becoming serious or permanently disabling.

Not long ago, industrial accidents were considered an unavoidable evil. The worker took the risk when he entered industry and bore the tragic results. But in the last decades the safety movement has brought a new spirit—the belief that the dangers of industry can be largely eliminated. Under this new doctrine, many employers' and workers' organizations have set to work with a will to eliminate accidents, and with most encouraging results. In the Portland cement industry, 120 plants reduced their accident frequency from 44.7 accidents per 1,000,000 man-hours in 1920 to 27.5 in 1925, a decrease of 29 per cent in accident frequency in 6 years. Many individual plants show even more striking records. A plant in the chemical industry, where risk is high, reduced its accident frequency from 67.8 to 33.5 from 1919 to 1925. Examples of this kind could be multiplied.

There has also been a movement to bring first aid and medical care to the worker at his work, where the injury occurs. The service of a plant doctor or first aid office is of the greatest value; many days and even weeks of suffering may be spared the victim of an accident if he has care at once.

As we look to the future development of this great movement to save life and prevent suffering, certain important aspects stand out. To accomplish them the co-operation of your organization will be needed and of all groups in every community who are interested in human welfare. We must develop a community spirit for accident prevention and prompt care for the victims of unavoidable injury.

We need first of all to press forward with greater energy along lines already suggested in the industrial safety movement. Important progress has been made in accident prevention and provision for medical and surgical care, but thousands of plants employing millions of workers have not yet been reached. The smaller plants particularly are slow to adopt safety measures, and to reach them we need a more vigorous community spirit for industrial safety. Your program of co-operation between members of your profession and community groups is fundamental. It can be developed to a powerful movement, reaching with practical measures to those who need it sorely, the worker at his bench in the factory, the street car operator, the taxi driver in the dangers of traffic, the building tradesman in the dizzy heights of the modern sky scraper. The safety movement is broad and all inclusive. There is not a single member of any community who does not need to know the dangers of accident which surround him, at work or in daily life, and who may at any moment need medical or surgical help.

Any movement for industrial safety will be successful if all groups combine their efforts. The co-operation of workers is particularly important. Their own organization, the trade union, gives them the means of contributing their ideas and suggestions to make a program practical. It furnishes the means of reaching each individual worker to educate him in habits of safety at work and secure his co-operation. The workers' co-operation and understanding is essential; no safety campaign can succeed without

it. The trade union can mobilize the workers' intelligence, initiative, and interest.

Short hours of work and a living wage are important promoters of safety, for accidents are more frequent with fatigue, low morale, and the physical deterioration of long hours and low wages. By setting standards for shorter work hours and higher wages, trade unions are already making a significant contribution to the safety movement.

As we consider various problems of promoting industrial safety, one stands out in particular: that of providing adequate safeguards against the dangers of new industrial processes. With the onrush of new inventions, new machines and processes are constantly being introduced into industry. We do not want to try them out with human loss of life or health before we discover their dangers. But too often no one takes the trouble to provide against the worker's injury when a new process is introduced. The paint spraying machine has cost heavily in cases of poisoning and loss of health; unguarded machines took untold lives in the metal industries; the dust from stone cutting machines caused lung trouble for thousands of workers. In work with all these and many other machines, workers paid a high price in loss of life and limb before the needed safety devices were introduced. We need to control new processes as they are introduced to make sure that the worker will be protected.

A particular danger is in the increasing use of chemicals in industries. We all know the heartbreaking record of the phosphorescent match industry and of the radio-active substances used for illuminating and other processes. Many of the chemicals just being introduced in new processes contain insidious poisons which may undermine workers' health. These should be studied before they are introduced in the production process and the proper safeguards provided.

Education is also essential. We need to develop the safety habit, which means first showing the worker the dangers which surround him and then teaching the safeguards until the habit of doing things safely becomes subconscious. Here again the worker's co-operation is necessary.

An important part of the safety habit is the use of proper care immediately after an accident occurs. The worker should be conscious of the medical and surgical facilities his community affords and know how to obtain them. The problem of expense should be carefully considered by the community where industrial medicine and surgery are needed, for often the high cost of medical care keeps workers from getting the immediate attention they need.

To lessen the terrible toll of industrial accident is one of the great humanitarian tasks of our times. A good start has been made, but the task is only begun. It involves intricate problems, industrial on the one side, medical and surgical on the other. It will require close co-operation, careful study, sincere devotion, and patient work. But what task in this age of the machine could be more worth the effort?

OUR RECOGNITION OF THE IMPORTANCE OF ORGANIZATION FOR THE CARE OF MEN AND WOMEN IN LARGE INDUSTRIES

E. F. Carter, Vice President, American Telephone and Telegraph Company: Along with the great expansion and concentration of business operations, there is entering more and more into the business idea the thought that consideration of the human unit to improve mental and physical productivity involves advice in periods of peace, stress, health, or sickness, and carries with it improved morale of workers as well as improved results in business operations.

Business, of course, has been aware of its responsibilities entirely apart from the question of the costs of medical and surgical care when employees are injured in the performance of their duties. The introduction of medical work in industry for the purpose of bettering production and happiness, as we see it, has come about as a result of the requirements which accompany the centralization of productive effort.

There have been at work various subtle social forces which have expressed themselves in different ways in the several industries. The Bell telephone companies in 1913, established and placed in operation a disability benefit plan. The company is the sole contributor. Employees when ill or injured benefit by payments regulated by wage scale and length of service. It developed, as time went on, that there was a distinct medical phase to the administration of the benefit plan, and medical people were gradually taken into the organization in various parts of the country. These doctors, at first, only advised those officials who had charge of the administration of the plan; but there has taken place a very natural evolution in the medical work connected with the plan so that the doctors in many of our companies now examine candidates for employment, give periodic examinations, examine employees after disability, and assist in health educational activities. We recognize now more clearly than ever before, the business advantages which result from an interest in the physical state of employees and that such an interest wisely and discreetly exercised is an important function of management. We have watched all sorts of medical work in industry, from the ultra-altruistic types to the ones based on plain common sense, and it is our belief that the introduction of medical work, while of the utmost value to the personnel, should be justified solely as good business. We do not assume the responsibility which belongs to each man and woman to look after his or her health or to decide what kind of medical advice to take, nor do we assume any of the responsibilities of the family doctor.

The question of health maintenance has introduced into the sickness problem of communities a feature which is only partially appreciated by the public, and which in all fairness can be no more than

partially borne by the medical profession. The public organizations such as health departments, naturally bear the greater part of the hazardous burdens of health maintenance, such as wholesale immunizations, epidemic safeguards, etc. The educational and diagnostic features of this increasingly popular subject should find a ready sympathy in the business executive exercising supervisory powers over large groups of employees.

It is not our policy to carry on the treatment of disease, or, where adequate surgical talent is available, the treatment of accident cases. In matters of treatment, first aid is our immediate objective and responsibility; with, in addition, a supervisory control of such an extent as to assure reasonably correct diagnoses, proper surgical care, hospitalization, and rehabilitation.

We do train our workers to understand first aid treatment and our employees do not hesitate to give first aid to others whom they may find injured on the highways or elsewhere when medical or surgical attention is not immediately available.

We endeavor to make more comfortable the employee who is taken ill while at work and to ascertain the cause of the disability. Here we have two objectives: (1) that of enabling the employee to return to work and continue at work, and (2) through the application of immediate diagnostic effort to place information concerning latent or active disease in the hands of the employee's medical advisor.

We believe that it is money well spent and in accordance with the theory of the administration of the benefit plan to know what our money is spent for in illness and in accident, both during the acute phases, as well as during convalescence, and to know that the company, the doctor, and employee are all equally participating in the advantages accruing from well directed diagnostic effort. The Bell System is not practicing medicine, nor does the medical work we do replace the interest of the boss in the sick or injured employee. We maintain medical units in the larger centers and widespread medical contacts throughout the land for the purpose of enabling management through its supervisory forces to keep in touch with the employee problems of sickness, ill health, accident, hospitalization, rehabilitation, etc. This has not been undertaken on the spur of the moment, but years of sober economic thought have passed during its evolution, and there is a continuing consideration of its advantages. It is our practice in suitable cases, after careful investigation of the facts, both in accident and in sickness cases, to spend our money in order to hasten the employee's return to work, and to insure proper physical ability to perform work. We depend on the medical talent of our organization to be in contact with the best available medical facilities in the various sections of the country, so that when difficult medical problems arise rather more than average skill and ability are brought to bear in their solution.

This company is engaged in the delivery of telephone service at the lowest possible cost to the public which will permit continued improvement in the service and a reasonable and safe return to those who have placed their savings in our business. The professions—engineering, accounting, economics, law, and medicine,—all are making definite contributions in the final production of that public service.

MY INTEREST IN THE CARE OF MEN AND WOMEN IN INDUSTRY

ALFRED E. SMITH, New York: Nothing can prove to be so destructive in the life of a family as illness caused by accident or injury to the breadwinner. It is altogether too easy to look upon the care of the sick as the private function of hospitals supported by voluntary contribution. My personal experience has been such that I have never been able to look at it that way. One of the first lessons I learned from the late Health Commissioner Herman M. Biggs was that public health was purchasable and that its administrative application to government, be it state or local, has wide significance.

Our earliest attempt to pass a workmen's compensation act in the State of New York met with disaster because it was declared unconstitutional. We were deterred from making further efforts until an amendment could be passed to the State Constitution, empowering the Legislature to enact the Workmen's Compensation Law. As soon as that became possible, the law was passed. Since that time, many attempts have been made to break down its effectiveness. Year after year it had to withstand attacks from organized industries, insurance companies, and others whose understanding of its wide usefulness was insufficient.

Gradually we forced wider and wider application of the act. In its earlier history, the law provided that an injured man must wait 2 weeks after the date of the injury before he could receive compensation for it. We shortened that period to 1 week. It provided insufficient compensation for some kinds of injuries and these discrepancies were remedied. One year we were able to persuade the Legislature that the money to which relatives of a deceased claimant would be entitled should not be allowed to remain with the insurance companies when there were no relatives but should be placed in a state fund for the rehabilitation of injured workers.

My interest in this problem extends even further than the situations created by the provision of a workmen's compensation law. My interest is a human interest. I have seen the devastating effect of illness on a worker's family. We still compensate inadequately because we have not yet succeeded in compensating for all diseases contracted in the course of occupation which are directly traceable to the occupation or industry itself. Until that law applies generally there will continue to be cases such as those of the workers suffering from radium poisoning in New Jersey a few years ago.

Not alone does injury or illness in the course of occupation affect workers' well-being but the condi-

tions under which they work must be safeguarded. It took a fire causing the death of over a hundred young working girls and the injury of scores of others to make New York State study carefully the provisions for the safety of industrial workers. After a legislative inquiry lasting 2 years, New York State passed the most enlightened labor law of any state in the Union.

Safeguards against fire, protective sanitation, proper ventilation, and similar provisions were looked upon not merely as legal safeguards but as actual preventive measures. The law limiting the hours of labor in factories and mercantile establishments and the law prohibiting night work for women were not merely restrictive measures but instruments which met the constitutional test in our appellate courts because they were declared to be measures of public health.

As a matter of fact public health seems to me to be of importance to the people as a whole and I would like to see some system whereby health information and proper medical treatment would be available to every man, woman, and child, regardless of position in the world, whether this be done through some form of health insurance or through a widely established system of public health clinics, acceptable to every type of community, rural as well as city. It is only a few years since I was able to demonstrate to the leading physicians of New York State who came from every part of the state to attend a conference at the executive chamber, Albany, that rural health was being neglected and that the state must be protected in safeguarding it. As a resolution we passed a law enabling the state to contribute 50 per cent toward any health work undertaken by the county. The success of this effort has been well established. Many counties not hitherto encouraged to undertake any public health work have done so. The lesson in the preservation of human life has been best illustrated in Cattaraugus County where an experiment was established, utilizing every conceivable health resource in that county, both public and private. It was co-ordinated and made to function so that every child came under its influence, even before it was born, and so that every adult came under its influence until the last of his days.

We have traveled far in learning new methods of caring for the public health. In the last 25 or 30 years we have learned the meaning of preventive medicine and we have learned more about the causes of disease. But it is difficult to carry knowledge to every home. Too many people are still ignorant of the importance of calling a physician. They do not realize the importance of that early stitch which saves nine others. Such a body as this can do much to further disseminate that knowledge. There is no asset of the state above and beyond a healthy citizenship. Health begins before the cradle in the care of the mother, and then of the infant from the hour of its first breath.

We found at the time of the war when we made careful health examinations that 33 per cent of the young men suffered a physical defect which could have been cured had they received attention in the early years of their lives. How much of this has since been corrected is hard to say. Only by constant effort and the constant dissemination of knowledge to the public can we hope to progress along these lines. Your organization must lead the way by giving us the scientific facts with which we can deal. But the State, using that word in its largest sense, must fix those facts into effective, administrative action.

COMMITTEE AND DEPARTMENT REPORTS

DEPARTMENT OF CLINICAL RESEARCH—ALBERT J. OCHSNER MEMORIAL

THE work in clinical research, which is being conducted by the College, includes that of the following committees:

Committee on the treatment of malignant diseases; committee on the archives of malignant diseases; committee on bone sarcoma; committee on treatment of fractures; committee on clinical laboratories; board on medical motion pictures; board on industrial medicine and traumatic surgery.

A minimum standard for cancer clinics in general hospitals has been formulated and published in SURGERY, GYNECOLOGY AND OBSTETRICS, 1931, lii, 1178–1181, and approximately five thousand reprints have been distributed. All hospitals with over one hundred beds in the United States and Canada, which are approved by the College—thirteen hundred seven—have been familiarized with this standard and we have statements from them concerning the way in which the cancer cases are being handled by them and the facilities and personnel available for the proper treatment of cancer cases. This is being followed through personal surveys by specially trained hospital investigators who are supplying the hospitals with all available information with reference to the cancer clinics and encouraging their organization in favorable situations. The response to this effort on our part has been most pleasing and we now have a list of sixty-eight hospitals which have clinics that merit the approval of the College and a long list of others which are in the process of organization or in which the subject is under active discussion by the administrators and staffs. On account of the limited time that the hospitals have had for becoming familiar with the standard and adopting it and that we have had for the survey, the present list is considered a tentative one and will not be published, but during the coming year this list will be perfected by personal visits by our representatives and published at the time of the next Congress. A set of uniform record blanks for histories of cancer patients is nearing completion.

Minimum Standard for Cancer Clinics in General Hospitals

1. *Organization.* There shall be a definite organization of the service, and it shall include an executive officer and representatives of all the departments of the hospital which are concerned in the diagnosis and treatment of cancer. The services of a secretary and of a social service worker shall be available.
2. *Conferences.* As an essential feature of the service there shall be regular conferences or consultations at which the diagnosis and treatment of the individual cases are discussed by all members of the clinic who are concerned with the case.
3. *Patients.* Reference to the cancer clinic of all patients in whom the diagnosis or treatment of cancer is to be considered shall be either voluntary or obligatory in accordance with the vote of the medical staff or of the governing board of the hospital.
4. *Equipment.* In addition to the diagnostic and therapeutic surgical equipment which is required in every approved general hospital, there shall be available apparatus for X-ray therapy of an effectiveness which is generally agreed upon as adequate, and an amount of radium sufficient to insure effective treatment.
5. *Records.* In addition to the records which are required in every approved general hospital, there shall be additional records of: (a) The details of the history and of the examination for cancer in different regions of the body, such as are indicated on the form records which are recommended by the Committee on the Treatment of Malignant Diseases, American College of Surgeons; (b) the details of the treatment by radium or X-ray as indicated on the form records which are recommended by the Committee on the Treatment of Malignant Diseases, American College of Surgeons; (c) periodic examinations at intervals for a period of at least 5 years following treatment.
6. *Treatment.* The treatment of cancer patients shall be entrusted to the members of the staff of the cancer clinic except in cases in which adequate treatment in accordance with the collective recommendation of the staff of the cancer clinic can be procured otherwise.

The Committee on the Treatment of Malignant Diseases has previously published five-year results of treatment of cancer of the breast and of the cervix, and the continuation of the studies of these cases and of cancer of other parts of the body is being continued and the results of the study will appear from time to time. The fact that we have complete records of a number of cases in which the patients have lived from 5 to 20 years after treatment—71 in the case of cancer of the cervix, 105 in the case of cancer of the breast, and 57 in the case of sarcoma of the bone—when added to the authenticated reports from many clinics in different parts of the world justifies us in making the definite statement that cancer of many parts of the body, if treated in time, may be successfully treated. There are academic questions that may arise in this connection but they in no way invalidate the statement, and this is a fact of which we wish to convince both the skeptical medical profession and the uninformed public. An examination of our analysis of about 50 cases of malignant bone tumors that have lived for more than 5 years following treatment should be convincing, even though some few of the cases may lack data which might be demanded by pure science.

There have been submitted to the Registry of Bone Sarcoma during the year 179 cases of which 123 have been registered. The activities of this Committee are submitted in a separate report.

The report of the Committee on the Treatment of Fractures is submitted separately.

In April, 1930, a committee was appointed for investigation of methods of treatment of cancer. This committee rendered a report a year ago and is continuing its observations.

The research on the use of the electrosurgical unit which has been conducted during the past year and a half under the auspices of this department has had the co-operation of 660 surgeons, who have furnished reports to the College on its use in 3,470 cases. These cases include involvement of practically all parts of the anatomy by a wide diversity of disease conditions.

It is natural that surgeons who restrict their activities to certain anatomical parts of the body have based their conclusions upon experience in their own specialty. However, the large number of reports from such a large group of surgeons as have co-operated in this study may be expected to eliminate the element of prejudice. There are certain cases in which the electrosurgical unit has been used as the sole instrument, while in other cases it has been used as an adjunct to the scalpel. There is a certain number of questions which inevitably arise in considering the usefulness of this type of surgery. Is it possible to accomplish with this instrument that which it would be impossible to accomplish otherwise, or are the results better than otherwise obtained? Experience has shown that certain things are possible by the use of this instrument which otherwise could not have been accomplished.

In a more general way it is essential to know whether or not postoperative hæmorrhage, infection, and pain are more or less frequent and whether the time of wound healing is hastened or delayed. Is the time required for operation diminished? Are the end-results such as to justify the use of this instrument?

There are certain advantages in the use of the electrosurgical unit which are universally conceded whatever the part of the body involved and whatever the disease may be. These advantages are its asepsis and the ease and rapidity of inducing hæmostasis and avoiding the use of a large number of ligatures. An advantage for it is claimed in the case of malignant tumors in that it seals the blood and lymphatic vessels and prevents dissemination of tumor cells. The period of the experiment has been too brief to give absolute proof of this claim. The ease with which hæmostasis may be produced makes it possible to perform operations on parts in which the use of ligatures would be difficult and at times impossible, as in operations on the central nervous system and in places that are so difficult of approach as the pharynx and larynx.

It would be of no benefit to enumerate all of the diseased conditions in which this instrument has been used in the course of our investigations but, in summary, it may be said, in answer to the query as to the types of cases in which its use has advantages, they are: brain tumors, as an adjunct for production of hæmostasis; in cancer, especially in massive removal of the breast; in thyroid operations, for the production of hæmostasis; removal of large portions of tissue, such as in amputations; in certain intraoral and intrapharyngeal tumors; for removal of circumscribed cutaneous lesions; for opening the stomach and intestine; in endocervicitis; in hæmorrhoids; in biopsies. Its advantageous use is not restricted to these conditions but they are the ones to which the most prominence has been given by those who have participated in the research.

With regard to postoperative pain, the evidence is in favor of a statement that this is lessened. The majority express the opinion that they have observed no advantage of electrosurgery over the scalpel with regard to postoperative pain, but there is a considerable number of surgeons who are convinced that the postoperative pain is lessened and some of them say very much lessened. None has considered postoperative pain to be increased.

With the question of wound healing the reverse is the case. While a few men note no delay in wound healing, the majority have found the time of wound healing to be somewhat prolonged, but in very few cases has this delay been sufficient to contraindicate its use.

As regards secondary infection the evidence is not conclusive. A decision on this subject would require more accurate data as to the type of cases and the condition under which the operation was performed. The investigators in this research have not indicated an increase in the frequency of secondary infection.

The evidence is in favor of a diminished frequency of secondary hæmorrhage with the use of the electrosurgical unit.

There are certain disadvantages in some types of cases with the use of the electrosurgical unit, but some of these disadvantages are overcome after the operator becomes familiar with the manipulation of the unit and its proper sphere. A diminution of the sense of touch, which is of such great importance to the surgeon, is complained of by some. There is a rather general fear concerning its use for finer dissections, especially in the neighborhood of large vessels and nerves. In spite of the claims of some manufacturers, a very considerable number of surgeons do not use it for skin incisions on account of a tendency to disfiguring scars and delayed healing. In these cases the unit is used on the deeper tissues. Some neurological surgeons emphasize the fact that immediately contiguous brain tissue is singed and surrounding œdema follows.

Explosive anæsthetics are spoken of as distinctly contra-indicated and where local or intravenous anæsthetics can be used they have been preferred. However, in this field, opinion is not unanimous and some surgeons have felt that the choice of anæsthetic depends to a considerable extent upon which part of the body is to be operated upon.

The sectional meetings, which have numbered seven this year, have furnished an unusual opportunity to the department for familiarizing the surgeons and hospitals with the work of the department of clinical research and its various committees. We have concrete evidence that the seed sown at these meetings has borne fruit in the form of organization of cancer clinics in places visited and a greater co-operation with the scientific activities of the College. More bone tumors have been registered from the places at which the meetings were held and these places will become sources of further contributions to our clinical research on the various phases of cancer.

In the exhibit at the Congress this year there appears a most instructive photograph of three life-size skeletons on which have been indicated the sites of the primary bone tumors in the Registry. This serves to show in a graphic and very striking manner the sites of predeliction of osteogenicsarcoma, Ewing's sarcoma, and benign giant cell tumor.

COMMITTEE ON THE TREATMENT OF FRACTURES

CHARLES L. SCUDDER, M.D., Boston
Chairman

I HAVE the honor to present to the Board of Regents the eighth annual report of the Committee on the Treatment of Fractures. There are now 40 members of the Committee. The resignation of Dr. A. P. C. Ashhurst of Philadelphia, has been accepted. Dr. Ashhurst has been of great help in the activities of this Committee and the loss of his able advice and assistance is deeply regretted.

The Principles and Outline of Fracture Treatment has been published and appeared as the *Bulletin of the American College of Surgeons*, 1931, xv, 1. The fundamental principles underlying the treatment of fractures are stated and a generally acceptable form of treatment of certain fractures is described in this publication. This *Bulletin* has been enthusiastically received, and has already received a distribution of four thousand copies in quantities of from one to five hundred. Copies of this *Bulletin* may be secured by addressing Dr. Bowman C. Crowell, Director of Clinical Research, 40 East Erie Street, Chicago. As this publication is reprinted such revisions and improvements will be made as seem necessary.

The regional committees, now numbering 25, are distributed throughout the United States and Canada. These committees are functioning in their several communities, their particular activities varying somewhat with local conditions. In general, it may be said that these committees are much interested in fracture work and form the direct contacts of the central fracture committee with the local hospitals and the profession. The ideals of the fracture committee are becoming more diffused and generally understood throughout the profession by reason of the activities of these regional committees. In the existence of these regional committees lies the future hope of the central fracture committee and our ultimate goal is the establishment of these groups throughout the entire United States and Canada. The growth of these groups should be closely supervised by the general fracture committee. These regional committees are helpful in maintaining hospital standards. While the treatment of fractures can never be standardized, a standard for certain phases of treatment can be set up and adhered to and thus the general practitioner will learn to do the right thing well at the outset, and he will come to learn when he must delegate what he cannot do to someone who can do it.

Sub-committees. The Sub-Committee on Steel Bone Plates and Screws, consisting of Doctors Philip D. Wilson, W. O'Neill Sherman, Major Norman T. Kirk, and Colonel William L. Keller, has completed its task. The Bureau of Standards at Washington, D. C., has established a standard for the manufacture of steel bone plates and screws. This commercial standard is circulated to producers, distributors, and users of steel plates and screws. The standard has been accepted by the leading

surgical instrument manufacturers, and hospitals have been notified of this action. The surgical profession is gradually being informed through appropriate channels of the existence of standard steel bone plates and screws. A standing committee representing the manufacturers, distributors, and users has been designated to have charge of any further revision of the standard.

The Sub-Committee on the Use of the Fluoroscope, consisting of Doctor William L. Estes and Colonel William L. Keller, has rendered its report and it has been published in the *Bulletin of the American College of Surgeons*, 1931, xv, 2. One thousand reprints of this report will be distributed at the Clinical Congress.

The Sub-Committee on the Moving Picture Film on the Treatment of Fractures has submitted the scenario to the Eastman Teaching Films, Incorporated, and at present has no further report.

The Sub-Committee on Fracture Organization has also rendered its report. It has been mimeographed and is in constant use. One thousand copies will also be distributed at the Clinical Congress.

The Sub-Committee on Medical Education, consisting of Doctors William Darrach, Frederic J. Tees, and Isidore Cohn, has been very active concerning undergraduate teaching in medical schools, graduate teaching, and the instruction of internes in the treatment of fractures. The report of this committee has been sent to approximately 2200 approved hospitals in the United States and Canada and to the professors of surgery at the various medical schools. Numerous hospitals have advised us that they have whole-heartedly adopted the recommendations of this committee, and others that they are in entire accord with these recommendations.

The Sub-Committee on the Ambulance, consisting of Doctors Robert H. Kennedy, Philip H. Kreuscher, and Colonel William L. Keller, is at present at work upon the standardization of ambulance equipment for the treatment of fractures and instructions to ambulance drivers and internes. It is anticipated that this committee will succeed in establishing more uniform and better treatment for these acute injuries.

The National Board of Medical Examiners and the Federation of State Boards are actively interested in including questions on fractures in their several examinations of candidates for licensure.

The American Railway Association has a permanent fracture committee which has accomplished considerable work during the past year. This group is manifesting great interest in the work of the Fracture Committee to improve the handling of fractures on the railways of this country. There are approximately 300 chief surgeons and 10,000 railway surgeons who are now handling these injuries in various ways and are looking to our committee for suggestions.

The American Red Cross requested the assistance of the general fracture committee in rewriting the section on fractures of their *First Aid Manual*, and this has been accomplished. The suggestions of the committee have been accepted and will appear in the next edition of the *Manual*, which is just being published. This puts the committee in touch with hundreds of first aid classes throughout the country.

The annual Fracture Oration was given last year by Dr. Dallas B. Phemister, professor of surgery at the University of Chicago, the subject being "Splint-Grafts in the Treatment of Delayed Union and Non-Union of Fractures." The oration this year is to be given by Dr. William Darrach, New York, professor of clinical surgery, Columbia University.

It thus appears that the general fracture committee is composed of 40 surgeons keenly interested in the improvement of the treatment of fractures, and co-operating with it there are approximately 150 surgeons constituting the 25 regional committees. These men, by making contacts with several agencies, namely, medical schools, hospitals, the American Railway Association with its surgical personnel, the Bureau of Standards at Washington, D. C., the Board of Medical Examiners, The American Red Cross, etc., by educational methods are slowly but surely raising the standards of fracture treatment.

Standard for Minimum Equipment for Fracture Treatment in Hospitals

1. That all general hospitals be equipped to care for fractures; that the minimum equipment for the transportation and emergency treatment of fractures be the following or its equivalent:

   Thomas upper extremity splints; Thomas lower extremity splints with traction straps, slings and buckle straps; Hodgen splints; coaptation splints, assorted sizes; Cabot wire splints; straight pieces of wood (of assorted length, width and thickness) for splints; plaster-of-Paris bandages; some form of overhead frame for suspension; suitable X-ray apparatus, including a portable machine, if practicable.
2. That it is highly desirable that one individual surgeon be responsible for the supervision of the care of fractures in each hospital service.
3. That special record sheets be used for fracture cases.
4. That a close follow-up be maintained on all fracture cases for such time as necessary to establish an accurate knowledge of end results.

The personnel of the Committee on the Treatment of Fractures is as follows:

Charles L. Scudder, Boston, *Chairman*
Frederic W. Bancroft, New York, *Secretary*

Nathaniel Allison, Chicago
Willis C. Campbell, Memphis
Isidore Cohn, New Orleans
H. Earle Conwell, Birmingham

Salvador Cordoba, Venezuela
Frederic J. Cotton, Boston
William R. Cubbins, Chicago
William Darrach, New York
Frank D. Dickson, Kansas City, Mo.
Eldridge L. Eliason, Philadelphia
William L. Estes, Bethlehem
W. Edward Gallie, Toronto
Fraser B. Gurd, Montreal
Donald Guthrie, Sayre
George W. Hawley, Bridgeport
Melvin Henderson, Rochester, Minn.
William L. Keller, Washington
Robert H. Kennedy, New York
Norman T. Kirk, Washington
Philip H. Kreuscher, Chicago
W. Estell Lee, Philadelphia
George A. Leland, Jr., Boston
Paul B. Magnuson, Chicago
Clay Ray Murray, New York
Lloyd Noland, Birmingham
Hubley R. Owen, Philadelphia
Dallas B. Phemister, Chicago
Edwin W. Ryerson, Chicago
W. O'Neill Sherman, Pittsburgh
Ernst A. Sommer, Portland
Kellogg Speed, Chicago
Frederic J. Tees, Montreal
Jorge del Toro, Porto Rico
John B. Walker, New York
Roscoe C. Webb, Minneapolis
George E. Wilson, Toronto
John C. Wilson, Los Angeles
Philip D. Wilson, Boston

COMMITTEE ON THE TREATMENT OF MALIGNANT DISEASES

ROBERT B. GREENOUGH, M.D., BOSTON
Chairman

I HAVE the honor to submit the following report of the Committee on the Treatment of Malignant Diseases.

Since the meeting of the College in Philadelphia in October, 1930, at which the first of the conferences on cancer clinics was held, much interest has been aroused throughout the country in the organization of cancer clinics in general hospitals, and many applications have been made to the committee and to its individual members for advice and assistance. The statement issued by the committee in October, 1930, giving the plan of organization recommended by the committee has been widely circulated, and it is known that 68 clinics in the United States and Canada already meet the established standard. One hundred twenty additional hospital groups have already indicated their interest and their desire to organize cancer clinics in accordance with the recommendations of the committee. Through the courtesy of Dr. MacEachern, investigators of the Department of Hospital Standardization, and some special investigators of the Board on Industrial Medicine and Traumatic Surgery and the Committee on the Treatment of Malignant Diseases, have been given instruction in procuring information in regard to cancer clinics in approved general hospitals. A suitable blank form has been prepared for recording the data thus obtained for the consideration of the committee. No announcement of the list of cancer clinics which merit approval will be made at this time as the investigation of the whole list is still incomplete, but it is expected that such a list can be published at the time of the annual meeting of the College in 1932.

At the sectional meetings of the College in 1930–31, Dr. Crowell and other representatives of the committee were given opportunity to describe the plan of organization recommended and to hold conferences with surgeons and hospitals interested.

The field representatives of the American Society for the Control of Cancer have given hearty support to the plan and they have been able to refer many surgeons and hospitals to the headquarters of the College for further assistance and advice in the development of special cancer clinics.

On Tuesday, October 13, 1931, a joint meeting was held of the Board of Regents of the College and the directors of the American Society for the Control of cancer. A spirit of the heartiest co-operation was shown and the opportunity for each organization to supplement and assist the work of the other was discussed and clearly defined. In this connection the committee would direct the attention of the Fellows of the College to the exhibit which has been prepared by the New York City Committee of the American Society for the Control of Cancer for the education of the general public.

In order that uniform records on cancer cases may be secured over the whole country, much effort has been expended by the members of the committee in the preparation of abstract record forms for cancer in its more important situations. A meeting of the Committee on the Treatment of Malignant Diseases was held this morning and abstract record forms were approved and will shortly be available for cancer of the following regions: cancer of the breast, cervix, fundus of uterus, ovary, thyroid, colon, rectum, lung and chest, œsophagus, larynx, mouth (including tongue and lip), prostate, kidney, bladder, testicle, and bone tumors. By the use of these forms it is hoped that a mass of accurate and uniform data will be accumulated in the organized clinics which will be of the greatest value in the future study of cancer.

In the meantime, the work of the committee in the collection of data on cancer patients living 5 years or more after treatment has been somewhat delayed, but individual investigation of cases in this time period are being carried on in several clinics.

It is the confident hope of the Committee that the greater interest in cancer work which has been aroused by these projects will bear fruit in an increased number of cases that will be recognized

and given effective treatment during the early and curable stages of the disease.

The personnel of the Committee on the Treatment of Malignant Diseases is as follows:

Robert B. Greenough, Boston, *Chairman*

A. C. Broders, Rochester, Minn.
Curtis F. Burnam, Baltimore
George W. Crile, Cleveland
Bowman C. Crowell, Chicago
William Duane, Boston
Edwin C. Ernst, St. Louis
Rupert H. Fike, Atlanta
John M. T. Finney, Baltimore
Burton J. Lee, New York
Frank W. Lynch, San Francisco
Robert T. Miller, Jr., Baltimore
Henry K. Pancoast, Philadelphia
H. Gideon Wells, Chicago
Francis C. Wood, New York

BOARD ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

FREDERIC A. BESLEY, M.D., WAUKEGAN, ILLINOIS
Chairman

IT is gratifying to report that as a direct result of a keen interest and the active initiative on the part of Dr. Franklin H. Martin, the Director-General, in the work of the board, it has been able to accomplish results that it is believed will be far-reaching in effectiveness in securing advancement in this department of medicine and surgery.

As a first step it was deemed advisable and desirable to establish a contact with as many large industrialists as possible and to secure their active correlation and support in this work. Appreciating the fact that many industries were operating their own clinics, some of them doing good work and some of them doing most indifferent and inefficient medicine and surgery, the Board formulated a minimum standard for industrial clinics.

1. That the industry shall have an organized medical department with competent medical staff including consultants and adequate emergency dispensary and hospital facilities and personnel to assure efficient care of the ill and injured.
2. That membership on the medical staff shall be restricted to physicians and surgeons who are (a) graduates of scientific medicine holding the degree of Doctor of Medicine, in good standing and licensed to practice in their respective states or provinces; (b) competent in the field of industrial medicine and traumatic surgery; (c) worthy in character and in matters of professional ethics, that in the latter connection, the practice of the division of fees under any guise whatsoever be prohibited.
3. That there shall be a system of accurate and complete records filed in an accessible manner—a complete record being one which includes identification data; cause of illness or injury; nature and extent of illness or injury; detailed description of physical findings; special examinations such as consultations, clinical laboratory and X-ray; tentative or provisional diagnosis; treatment; prognosis with estimated period of disability; progress of illness or injury; final diagnosis; condition on discharge; end-results; and such additional information as may be required by statute for Workmen's compensation claims or for other purposes.
4. That all patients requiring hospitalization shall be sent to institutions approved by the American College of Surgeons.
5. That the medical department shall have general supervision over the sanitation of the plant and the health of all employees.

Two excellent men, Dr. Williamson and Dr. Newquist, were employed to make a survey of the industrial and other types of clinics to ascertain which ones conform to the minimum standard which has been established by the Board. These men have done splendid work.

There have been surveyed, reported upon, and the records carefully analyzed, 174 clinics of which 84 are approved as meeting the minimum standard.

In a large majority of instances the leaders of industry have shown a deep interest in the program the College has formulated and is attempting to execute, and they have been most co-operative in their attitude toward the investigators. A large amount of data has been secured which will furnish facts and figures for a basic study of this vast and important situation and a knowledge of all these circumstances will place the College in a position to influence and direct some rational plan for improvement in the care of traumatic cases.

One interesting observation that was made was the real desire the industrialists expressed for the approval of the College for their individual clinics. Obviously, this is important for it furnishes the impetus for raising standards.

The personnel of the Board on Industrial Medicine and Traumatic Surgery is as follows:

Frederic A. Besley, *Chairman*
Bowman C. Crowell, *Secretary*

J. E. Bacon, Miami, Ariz.
Samuel R. Cunningham, Oklahoma City
Donald Guthrie, Sayre, Pa.
Lucian H. Landry, New Orleans
A. D. Lazenby, Baltimore
C. F. Martin, Montreal
Charles H. Mayo, Rochester, Minn.
Thomas G. Orr, Kansas City
W. O'Neill Sherman, Pittsburgh
Loyal A. Shoudy, Bethlehem
Ernst A. Sommer, Portland
Henry A. Staib, Chicago
Frederick J. Tees, Montreal
John B. Walker, New York

REGISTRY OF BONE SARCOMA

BOWMAN C. CROWELL, M.D., CHICAGO
Registrar

I HAVE the honor to submit the following report on the Registry of Bone Sarcoma.

There have been submitted to the Registry of Bone Sarcoma during the year 179 cases of which 123 have been registered. Five hundred forty-eight case records have been sent around among 26 men, and their opinions on these cases have been furnished to the surgeon who registered the cases. The Registry has been considerably used during the year as a consulting bureau on bone tumors, as surgeons, pathologists and radiologists have sent information on current cases for opinions as to diagnosis and advice as to treatment. There are now 1,272 cases in the Registry. Facilities for a museum on this subject at the College have become available and a considerable number of specimens have been mounted and are on display with the complete records including X-rays and sections of the cases. The facilities thus offered for study of the complete cases are becoming more and more utilized by visiting surgeons, radiologists and pathologists. The number of gross specimens that we are receiving is not as great as we would like, but is increasing each year. There has been no meeting of the committee this year, but the work which was done at the last meeting of the committee has been prepared for publication and within a few weeks there will be published a critical analysis of the 5-year cures, with discussion on treatment.

Two Chicago surgeons are now spending 3 half days a week in studying the material of the Registry and in making detailed reports on gross specimens before mounting.

The personnel of the Committee on Bone Sarcoma is as follows:

Dallas B. Phemister, Chicago, *Chairman*
Bowman C. Crowell, Chicago, *Registrar*

Edwin I. Bartlett, San Francisco
Joseph C. Bloodgood, Baltimore
Barney Brooks, Nashville
Ernest A. Codman, Boston
Charles L. Connor, San Francisco
James Ewing, New York
W. R. Galbreath, Porto Rico
Frank W. Hartman, Detroit
Henry W. Meyerding, Rochester, Minn.
John J. Morton, Rochester, N. Y.
Luis Razetti, Venezuela
Channing C. Simmons, Boston

STATE AND PROVINCIAL SECTIONAL MEETINGS

SEVEN sectional meetings of the College have been held since January 1, 1931 These meetings are becoming increasingly effective in stimulating clinical surgery, hospital betterment, scientific medicine, and in informing the public on matters pertaining to health, disease, scientific medicine, and hospitals. The meetings are planned in such a way as to give emphasis to each of the four named activities of the College. Clinical surgery receives its stimulus through the holding of surgical clinics by local surgeons on each morning of the 2 day meeting. Hospital betterment is the subject of constructive discussions and presentations during the entire 2 days of the meeting. Advances in scientific medicine are presented by clinical addresses during the noon hour on each day and scientific papers on the afternoon of the second day of the meeting. On the evening of the first day of the meeting a banquet is held at which are presented silent and talking medical motion pictures prepared under the auspices of the Board on Medical Motion Picture Films of the College.

The education of the laity in matters pertaining to health, disease, scientific medicine, and hospitals constitutes one of the major activities during all meetings. Several agencies are employed for this purpose. The lay press is furnished with numerous articles on scientific medicine, prior to and during the meeting, and with numerous interviews by visiting speakers during their sojourn in the city in which the meeting is held. Health talks are given to the children through the courtesy of the departments of education who make it possible for visiting speakers to present their subjects at assemblies in auditoriums of the high schools for periods of 20 minutes to 1 hour each. The number of high schools at which such talks have been given during this series of sectional meetings has been as high as 20 in some cities, and the number of high school children addressed ranges from ten to fifteen thousand in each city. Numerous health talks are broadcast over the radio, and a community health meeting is held in each city. At these meetings the visiting speakers presented their subjects to audiences, which varied from one to three thousand.

The noon-day service clubs and chambers of commerce have co-operated wholeheartedly in furthering this lay educational program and speakers have appeared before outstanding clubs of this nature.

A preliminary visit to the city by an official of the College results in stimulating interest in the ensuing meeting and in the formation of a local committee of arrangements who are then presented with a general outline of the character of the meetings, along with suggestions as to the methods that experience has taught the College to be most suitable for procuring the desired results. The wholehearted co-operation of the local Fellows of the College in making the arrangements for the meetings has been reflected in the very successful sessions which have been held this year.

An unusual feature of the sectional meetings in 1931 has been the holding of a 3-day sectional meeting in Oakland, California, with the participation of seven states and one province. At this convocation two large community health meetings were held. This constituted the largest sectional meeting which the College has held.

Sectional meetings have been held in 1931 as follows: Missouri, Kansas, Iowa, St. Joseph, January 5–6; Arkansas, Oklahoma, Texas, Little Rock, January 9–10; Louisiana, Alabama, Mississippi, Florida, Georgia, New Orleans January, 12–13; Kentucky, Tennessee, Nashville, January 16–17; Ohio, Indiana, West Virginia, Cincinnati, January 19–20; Nebraska, Lincoln, February 9–10; California, Nevada, Arizona, Idaho, Utah, Oregon, Washington, British Columbia, Oakland, April 23–24–25.

The visiting speakers at these meetings included: Doctors Alfred W. Adson, Rochester; Frederic A. Besley, Waukegan; Vilray P. Blair, St. Louis; Joseph C. Bloodgood, Baltimore; Louis H. Clerf, Philadelphia; George W. Crile, Cleveland; Bowman C. Crowell, William R. Cubbins, Irving S. Cutter, Chicago; Frank D. Dickson, Kansas City; Frederick C. Herrick, Cleveland; George J. Heuer, Cincinnati; Harvey J. Howard, St. Louis; Edward Jackson, Denver; Allen B. Kanavel, Philip H. Kreuscher, Chicago; Burton J. Lee, New York; Paul B. Magnuson, Franklin H. Martin, Malcolm T. MacEachern, Chicago; James R. McCord, Atlanta; C. Jeff Miller, New Orleans; Harry E. Mock, Chicago; Gordon B. New, Rochester; Alton Ochsner, New Orleans; Max M. Peet, Ann Arbor; Harry L. Pollock, Chicago; T. R. Ponton, Augusta; Arthur W. Proetz, St. Louis; Harry M. Richter, Chicago; Judge H. M. Stephens, Berkeley; and Robert Jolly, Houston.

THE CREDENTIALS COMMITTEES AND COMMITTEE ON HISTORY REVIEWS

DWIGHT F. CLARK, M.D., EVANSTON, ILLINOIS

THE procedure of admitting candidates to Fellowship in the American College of Surgeons requires that each candidate, after filing his application, be recommended by his State or Provincial Credentials Committee before proceeding further with his papers. In each state and province there is a Credentials Committee composed of from 15 to 35 members who are Fellows of the College, elected to serve on the Committee by the Fellows of the College of their respective state or province for a term of 2 years, one-half of the Committee being retired each year.

No candidate is admitted to fellowship without the recommendation of his State or Provincial Credentials Committee.

The members of these committees give generously of their time and meet at a designated city in their state or province at least once a year and review the credentials of all candidates whose applications are on file from their respective state or province. Much credit is due these committees for their part in the work of the selection of the men who comprise our fellowship.

After a candidate for fellowship has been recommended by the Credentials Committee of his state or province, he is required to submit 100 clinical records to the College, 50 in complete detail of major work done by himself and for which he is the responsible surgeon and 50 in abstract of major work at which he has assisted or which he has done himself. These records are carefully examined by the committee on history reviews composed of outstanding surgeons in the fields of the surgical specialties from the four leading medical universities in Chicago.

This year 621 sets of histories were received and of that number 588 sets or 58,800 individual histories were examined in detail by the committee on history reviews. The remaining 33 sets were not reviewed as the applicants had not yet received the approval of their State or Provincial Credentials Committee. Of those reviewed, 509 sets were accepted and 79 sets were not accepted. Those whose histories were not accepted have the privilege of later submitting additional histories.

Twenty-one meetings were held by the committee on history reviews for the purpose of studying histories and during the 4 weeks preceding this meeting many additional hours were spent by the members of this committee in order that every candidate's records received this year might be reviewed.

The records, half of which were histories of cases of major operations performed by the candidates and the other half abstracts of cases which they had operated upon themselves or at which they had assisted, were checked with the utmost care, particularly with respect to the pre-operative data, indicating the thoroughness with which the case was studied, the technique, and the end-results.

The histories which were recognized as being of unusual merit were segregated and were the subject of a special review of the committee as a whole for the selection of those which were considered from the standpoint of completeness, accuracy, and form of presentation to merit special mention.

The members of the committee on history reviews who have served this year are:

James H. Bloomfield
Dwight Freeman Clark
Harry Culver
Frank E. David
Joseph E. Eisenstaedt
Harry Jackson
Oscar H. Kraft
Philip H. Kreuscher
Golder L. McWhorter
George J. Musgrave
Oscar L. Nadeau
Rudolph J. E. Oden
Charles H. Parkes
Charles H. Phifer
Guy E. Van Alstyne

MEDICAL MOTION PICTURE FILMS

J. Bentley Squier, M.D., New York
Chairman

THE co-operation of the American College of Surgeons and the Eastman Kodak Company (through its subsidiary, the Eastman Teaching Films, Inc.) in developing the production and use of motion picture films for teaching medicine and surgery, has resulted in the release of four new films during the past year. Seventeen such films have been completed, approved by the College, and are now available to the medical profession. With two or three exceptions they are made in both the 35 millimeter and 16 millimeter size, and may be rented or purchased by any professional group or individual.

Four additional already-existing films have also been approved, subject to satisfactory minor changes.

More than one hundred reels of films produced independently by other organizations and individuals have been reviewed at the office of the Board in Chicago during the year.

The Board is keenly interested in developing the production and use of talking films. During the past year improvements have been made in recording methods and in projection equipment that will be important factors in the application of this medium to the teaching of medicine and surgery. Much time and thought has been given to plans for active co-operation with some of the organizations that are especially interested in this phase of the work.

Film exhibitions are an important and popular feature on the program at the Clinical Congress each year, and at all sectional meetings of the College. A number of special showings that have been given to demonstrate the value of motion pictures for use in nurses' training schools indicate a very definite interest in films suitable for this purpose. Several articles discussing the application of films to various branches of medical teaching have been published in the College *Bulletin*.

THE LIBRARY AND DEPARTMENT OF LITERARY RESEARCH

WITH June of 1931, the Library and its allied Department of Literary Research have completed ten years of service in behalf of the Fellows of the College. At the time of its inception, the Library consisted of the very splendid collection assembled by Dr. John B. Murphy, a gift to the College through the generosity of Mrs. Murphy. This collection of some two thousand volumes included many of the choicest of scientific works representative of the fields of anatomy, physiology, and pathology. The surgical portion of the Library included interesting collections on orthopedic, abdominal, and genito-urinary surgery, in addition to the best of the general surgical monographs. With this very fine collection as a nucleus, the Library has increased in size and usefulness. In 1925 the John B. Murphy Memorial Building was erected, and the Library was moved into new and expansive quarters on the upper floor of that building.

Through the generous interest and effective efforts of the Fellows, the collection has continued to develop. The Library is, first of all, a depository for the works of the Fellows. Each Fellow, therefore, has been asked to present one copy of each book and two reprints of each article which he has written. The response to this request has been very satisfactory. During the past year alone more than two hundred current texts have been presented to the Library. These with the many reprints which have been received are a worthy representation of the literary and scientific work of the Fellows. The monographs have been placed on the open shelves of the reading room where they are available to visiting Fellows for reference; the reprints are divided, one copy being placed in the Fellow File as a permanent record of the work of the writer, the other being classified and placed in the Package Library section where it is available for loan in connection with the clinical and literary investigations of other members of the profession.

As the Library is to contain a collection of works of historical interest, Fellows and friends of the College having collections which they are willing to contribute or knowing of libraries or individual volumes which might be available are asked to notify the Librarian so that the necessary arrangements for obtaining them may be made. Old volumes of historic interest, reference works, and bound or unbound journal files have a place in the College Library. If the collection is large, it is advisable to submit a list of the volumes which are available in these private libraries, so that duplication of the material already assembled at the College may be avoided.

During the past 10 years several notable collections have been contributed. Outstanding among these are the H. W. Mills collection on hydatid cysts, the ophthalmological library of the late Dr. Orrin LeRoy Smith, and the extensive accumulation of older theses obtained through the interest of Dr. Hamilton Stillson, Seattle. The bound journals, largely foreign, contributed by Dr. George N. J. Sommer, Trenton, and the gifts of Drs. E. L. King, New Orleans; Mary McEwen, Chicago; P. E. Stangl, St. Cloud; and William M. Thompson, Chicago, have been incorporated in the reference section increasing its sphere of usefulness. A study room in the College Library contains the personal library of Dr. Albert J. Ochsner, together with pictures and mementos indicative of his broad interests as well as his unique position in the surgical world and his unceasing interest in and activity on behalf of the College.

Among the more recent gifts is the collection of H. Winnett Orr in the field of orthopedic surgery. A portion of this collection has already been received at the College including sixteenth, seventeenth, and eighteenth century writings of very great interest to collectors of historical works, as well as to persons making investigations which extend back into the early development of medicine and surgery. It is very fitting that such a collection should be presented to the College where it becomes the property of this large group of professional men and will be preserved for the edification and enjoyment of future generations in the profession.

DEPARTMENT OF LITERARY RESEARCH

In conjunction with the Library, the Department of Literary Research was established to assemble data from the literature for Fellows desiring information on medical or surgical subjects. A staff of workers trained in the preparation of bibliographies, abstracts, and translations is maintained to make investigations on behalf of those Fellows of the College who do not have trained language and research workers in their own clinics. Thus the surgeon who is located at some distance from a large medical library, or who is too much occupied with his other professional duties to spend hours in a medical library, or who lacks the equipment to do the reading in the various languages, may take advantage of the collection in the Library of the College and of the services of the staff, equipped to do this work for him. The regular staff includes workers experienced in making translations from the German, French, Italian, Spanish, Dutch, and Scandinavian literature and associated translators are available to provide for requests for material from the less frequently required literature in the Russian, Polish, Bohemian, and Japanese languages. Package Library material on a great variety of subjects is ready for loan, forming a desirable adjunct to the more comprehensive service offered by the translators and abstractors. Material has

been furnished to individuals and to committees and clinics to aid in the preparation of papers, the study of clinical cases, the development of experimental work, or to meet any other need which may arise. No Fellow of the College is located at too great a distance to receive the benefits of this service; no request is too comprehensive or too trivial to receive the careful attention of the staff. A brochure descriptive of the plan of the Department will be forwarded upon request. It is the aim of the Department to render a complete and satisfactory service in this field and to cooperate fully with any Fellow who is in need of service.

NEW YORK COMMITTEE ON ARRANGEMENTS

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Members of the Board of Governors for term expiring in 1933: Joseph A. Crisler, Memphis; James Raglan Miller, Hartford, Connecticut; Donald Guthrie, Sayre, Pennsylvania.

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HOSPITAL STANDARDIZATION

REPORT OF 1931 CONFERENCE IN NEW YORK

THE papers and discussions given at the Hospital Conference held during the Clinical Congress of the American College of Surgeons in New York and Brooklyn, October 12–16, 1931, are presented in abstract form in the following pages. Inasmuch as manuscripts of all the papers and discussions were not available, the full scope of the program is not indicated by the abstracts here presented. Papers will be published in full in the *Bulletin* of the American College of Surgeons and other journals during the coming year.

THE OBLIGATION OF THE HOSPITAL TO THE INTERNE STAFF

C. JEFF MILLER, M.D., New Orleans: In the near future the minimum standard for hospitals must be substituted by a maximum standard in which the criterion will be increased emphasis on the type of staff, particularly a staff equipped and willing to furnish the training which a medical graduate has a right to expect in his interne year. Internes are regarded too often as persons whose function is to relieve the staff of routine tasks, whereas they should be considered chiefly as advanced medical students. They need no further didactic instruction but they do need to be trained in the clinical aspects of the medical art. It is the responsibility of the hospital staff and the hospital administration, therefore, to see to it that the internes are given the sort of training which will equip them for their future professional careers.

It must be kept in mind that the interne is not in the hospital to learn surgery. He should be made to realize by the example of the staff that the practice of surgery requires long, specialized training. No hospital should permit first year internes to do surgery independently, even under the strictest supervision, and it would be better if the privilege were not extended even to second year internes. The present light hearted attitude of young men to undertake surgery is largely the fault of their seniors, who have permitted them in their training to operate independently and who have allowed them to believe that such experience is all that they need to set themselves up as independent surgical specialists. It should be remembered that the internes being trained today are the physicians and surgeons of tomorrow and that therefore they must be taught not only the mechanical and material side of medical practice but the ethics of their calling and the ideals of their art.

SOCIAL IDEALS IN HOSPITAL SERVICE

ALLEN B. KANAVEL, M.D., Chicago: There are two critical tendencies apparent today that should leave no true friend of medicine and the public without concern. These are, first, the great increase in the number of quack physicians and faith healers and, second, the complaint of the mounting cost of medical care.

The only solution for both problems lies in a more general appreciation of the advances in scientific medicine. To the hospital will fall in large part the duty of initiating and supporting this educational movement.

Exploitation of the patient by the charlatan and the faith healer is a problem that cannot be solved by legislation, for legal restriction can go no faster than public education, and in the present state of public education any attack by physicians is misunderstood and attributed to jealousy and factional discord.

In the face of the public criticism as to the charges made by hospitals, these institutions should give intensive study to the possibility of at least a partial reduction in fees and justify by education the part remaining. Among the means of lowering charges to patients are: the construction of moderate priced buildings so arranged as to permit simplified service, particularly nursing; the freeing of the private patient from the overcharge incidental to the care of free patients; the building of hospitals only after an analysis of community needs; and the co-operative use among hospitals of such departments as radiology, pathology, social service, etc.

Even when all these steps have been taken, the demands for scientific and efficient service will still require a charge greater than the ill-informed public expect, and hence along with this intensive study of economics must go education. To this end the hospital must keep in closer contact with the public. Hospitals must cease to be an expression only of institutions to which persons go when sick but should become centers for the prevention as well as the cure of disease. They must co-operate actively with all community health movements, and in them should be established the executive offices of the various public health agencies.

Public lectures by well informed laymen and physicians who are drafted for the purpose should be sponsored by hospitals. Public exhibits demonstrating the sources of contagious diseases and how to combat them, the treatment of emergencies, and

similar subjects should also be a part of their campaign of education.

Nothing would arouse and maintain interest in hospitals more than the initiation and support of clinics for the yearly health examination. Such clinics should be supported by the profession as a whole, the hospitals furnishing the facilities. These clinics could be organized after the manner of examining boards during the World War, where, with physicians assigned to examine for each specialty, scores could be cared for in a single evening and yet an efficient examination made.

THE PRESENT PROGRAM OF THE AMERICAN COLLEGE OF SURGEONS

FRANKLIN H. MARTIN, M.D., Chicago: In presenting the fourteenth annual report of hospitals which had been approved by the American College of Surgeons, Dr. Martin stated that there was no responsibility which he considered of greater importance than that of his yearly report to the Hospital Conference.

It is the duty, he said, of every community to furnish hospital facilities sufficient to care for every individual of that community who may require hospital care, and it is equally important that every community provide means so that the scientific physician may have the aids essential in conducting diagnostic examinations and a place where his sick patients may receive treatment.

The American College of Surgeons has accepted the leadership in co-ordinating the three important factors—the public, the physician, and his most essential environment, the hospital. The task of securing the proper facilities for the qualified practitioner is stupendous, judged from the administrative standpoint. Nor is the financial burden small, considering that the budget of the College is maintained by its 10,000 Fellows.

The 1931 report on hospital standardization revealed that in the group of institutions having 100 beds and over, 1,491 were surveyed, of which 1,392 were fully or conditionally approved; that there were 1,040 hospitals of 50 to 99 beds surveyed and 632 of them fully or conditionally approved; that there were 809 hospitals of 25 to 49 beds surveyed and 154 of them fully or conditionally approved; and that the 109 federal hospitals which were surveyed were fully approved.

On October 1 of each year, all hospitals under survey are automatically removed from the approved list and reconsidered for rating. Since October, 1930, 29 hospitals were demoted and 8 were removed from the list. Institutions are demoted or removed from the list if they harbor irregular practitioners, if the medical staffs fail to conduct clinical conferences, if the physicians indulge in fee-splitting, if approved laboratories and X-ray departments are not maintained, and if adequate case records are not kept. Failure to meet any one of the requirements is recognized as sufficient cause for removal from the approved list.

ANALYSIS OF FINDINGS FROM THE 1931 HOSPITAL STANDARDIZATION SURVEY

MALCOLM T. MACEACHERN, M.D., Chicago: The Hospital Standardization movement grows steadily in enthusiasm and in number of institutions surveyed. During the year 3,340 hospitals were on the survey list and sought approval. A series of lantern slides presented showed an analysis of the growth of the movement and the results of the 1931 survey.

Attention was called to the fact that notwithstanding the economic depression with the resultant decrease in occupancy and the increased demands for charity service, hospitals generally are adhering to their high standards of service in compliance with requirements of the American College of Surgeons.

A notable advance in medical organization has been observed throughout hospitals during the past year. This is of pronounced effect in assuring better control and supervision over the clinical work. A well organized staff presupposes a chief of staff and competent heads of clinical departments, who, forming a medical board or executive committee, should be responsible to the governing body for the development of the institution's professional policies.

There has been a decided improvement in clinical records and a greater utilization of their contents. The closer affiliation of the record department with the medical library has stimulated the study of end-results and clinical research. Hospitals are more and more appreciating the worth of the great mass of reliable, scientific data embodied in clinical records and the need for using this to greater advantage.

Good medical organization, accurate and complete clinical records, and proper use of diagnostic and therapeutic facilities, all lay an important foundation for the clinical conference so essential to good care of the patient. The staff conference of the present day is gradually evolving into an "analysis of performance," thus carrying out the original idea of making it a means of reviewing and examining into the fatalities, unimproved cases, complications, infections, and scientific work not up to the accepted standard.

More and more it is apparent that the program of Hospital Standardization is one of growth and development. Like a tree with its branches, the program has many ramifications all coming from the parent stem, the minimum standard. Already a number of special groups of minimum standards applying to distinct phases of hospital procedure have been developed and others are being formed.

It may be said that hospital standardization in its broadest interpretation as set forth in the *Manual* now offers a solution to meet most of the administrative and scientific problems of any hospital.

THE PROGRAM OF THE AMERICAN COLLEGE OF SURGEONS FOR THE CARE OF THE ILL AND INJURED IN INDUSTRY

FREDERIC A. BESLEY, M.D., Waukegan, Illinois: The speaker announced that a survey being con-

ducted by the American College of Surgeons showed that to date the medical service in 84 industries has been approved.

The minimum standard for industrial medicine and traumatic surgery was revised during the past year so as to include all the requirements essential for the adequate care of the sick and injured in industry. As one of the requirements the College requests that industries utilize only approved hospitals for the care of their ill or injured employees and that the physicians who care for them be scientifically trained and thoroughly experienced.

The College recommends that all traumatic cases in a given hospital be assigned to staff members specially trained in this branch of surgery and that each case be assured the advantage of consultation with and control by the surgeon or surgeons appointed to supervise this work. The plan raises an economic question, but it is believed that this is not insurmountable. It may be possible to secure these consultations without remuneration to the surgical consultant and thus in no way interfere with the fee of the attending doctor.

The Board on Industrial Medicine and Traumatic Surgery is taking cognizance of the rising ratio of cost per patient involved in rendering better service and of the increasing number of automobile accident patients who fail to pay any fee to hospital or doctor, and is seeking to remedy these economic problems. The board welcomes any suggestions that may be made by hospital directors that will aid in bettering the present deplorable conditions. The angles of approach may possibly be through the correction of laws relative to insurance on automobiles or the bonding of drivers who are not financially responsible.

ORGANIZING A SERVICE FOR THE DIAGNOSIS AND TREATMENT OF CANCER IN AN APPROVED HOSPITAL

BOWMAN C. CROWELL, M.D., Chicago: To date cancer clinics in 68 general hospitals have been approved by the American College of Surgeons. The survey of clinics for the diagnosis and treatment of cancer is still under way and announcement of the others meeting requirements will be made in the near future.

During the current year a minimum standard for cancer clinics was devised by the Committee on the Treatment of Malignant Diseases, of the American College of Surgeons. The merits of cancer institutes and cancer laboratories are fully acknowledged, but it is felt that there is an urgent need for making present knowledge more effective and that this need can be met most efficiently through the formation of cancer clinics in approved general hospitals. Such hospitals, since they are already functioning, form the natural centers in which modern diagnostic and therapeutic procedures can be conducted. Ordinarily these hospitals have the personnel and equipment for such service but a definite organization is necessary in order to obtain the maximum efficiency in the campaign against cancer. Though the minimum standard applies especially to hospitals, other institutions that are shown to have the required personnel, organization, and equipment for carrying on the work may be included in the list of cancer clinics approved by the College.

The minimum standard for cancer clinics requires: (1) that there shall be a definite organization of the service to include an executive officer and representatives of all departments which are concerned in the diagnosis and treatment of cancer and that the services of a secretary and a social worker shall be available; (2) that there shall be regular conferences at which the diagnosis and treatment of the individual cases are discussed by all members of the clinic concerned with the case; (3) that reference to the cancer clinic of all patients in whom the diagnosis or treatment of cancer is to be considered shall be either voluntary or obligatory in accordance with the vote of the medical staff or of the hospital's governing board; (4) that in addition to the diagnostic and therapeutic surgical equipment required in every approved hospital there shall be available an apparatus for X-ray therapy of an effectiveness generally agreed upon as adequate and an amount of radium sufficient to insure effective treatment; (5) that besides the records required in an approved general hospital there shall be additional records of (a) the details of the history and of the examination for cancer in different regions of the body, such as indicated in the forms recommended by the Committee on the Treatment of Malignant Diseases, (b) the details of the treatment by radium or X-ray as indicated on the forms recommended by the same committee, and (c) periodic examinations at intervals for a period of at least 5 years following treatment; and (6) the treatment of cancer patients shall be entrusted to the members of the staff of the cancer clinic except in cases in which adequate treatment in accordance with the collective recommendation of the staff of the cancer clinic can be procured otherwise.

The essential feature of a cancer clinic is the group method of study of cancer cases. This is accomplished by a conference of the staff. Such a meeting may be held daily or at longer intervals. The American College of Surgeons seeks to co-operate with cancer clinics by furnishing information as to methods of organizing such clinics, by putting its stamp of approval on those conforming to the standards, by supplying samples of uniform record blanks, by compiling and publishing the results of statistics furnished by cancer clinics, by publishing in the *Bulletin* of the College articles dealing with the work of cancer clinics, and by giving the staffs of the latter an opportunity to discuss administrative problems in a series of round table conferences.

RESPONSIBILITY OF THE FELLOWS OF THE COLLEGE IN PROMOTING THE HOSPITAL STANDARDIZATION PROGRAM

SOUTHGATE LEIGH, M.D., Norfolk, Virginia: The founding of the American College of Surgeons undoubtedly revolutionized surgery in the United

States, and all honor is due to the organization's founder.

The aim of the College was and is to put its stamp of approval on every safe surgeon of high character and good standing. Naturally in an organization such as this, some individuals may have been admitted in the past who were below standard and a number may have been excluded who should be Fellows. To avoid these mistakes each member of each committee must be fully alive to his responsibility. The present method of committee selection and examination should assure a high grade membership.

Though in every medical society each member should do his part, yet the work is usually carried on by a few, and the organization nevertheless does not suffer. The American College of Surgeons differs in this respect in that each member has a distinct duty to perform and responsibility to bear. If he is not willing to do his part he should resign.

The first duty a Fellow owes to the College is so to conduct himself as a surgeon as to reflect credit on the organization. His next duty is to lend aid to the younger surgeons in order that they may meet the College's standard. Without prejudice for or against, he should approve or disapprove of the applicants for fellowship and advise those who are below standard how to meet the requirements.

The surgeon's duties in connection with hospitals are manifold. While he may not have full authority, yet he can at all times use his influence for all that is best in hospital conduct. Surgical cleanliness, for instance, will never be obtained with surety unless there is much stricter control of the operating rooms by a suitable member of the surgical staff. In a general hospital there should always be at least two operating rooms, one for clean cases and one for septic cases, and, so far as possible, no septic case should be treated in the room reserved for clean ones. Operating rooms and wards must be kept clean, and all septic materials promptly destroyed.

Insistence upon full histories and complete reports of examinations of all cases is a great safeguard in a general hospital. Fellows must see to it not only that these records are properly kept but must also concern themselves with staff meetings and many other details of hospital procedures.

In open staff hospitals the responsibility of Fellows is greatest. They must see to it that rules governing the privilege to practice surgery are made and enforced. The increasing tendency of general practitioners to perform surgery is unfortunate. Untrained men must not be allowed to meddle with human life. Undoubtedly a great deal of the increased mortality from appendicitis is due to untrained operators. No man should be permitted to operate for appendicitis unless he is skillful enough to cope with a case of general peritonitis. In fact, unless the operator is qualified to handle any condition which may arise, he should not be permitted to open the abdomen at all.

In lieu of legislation restricting surgery to persons of special qualifications, which will require time before it is put into effect, Fellows of the College should see to it that in the hospitals with which they are associated untrained and unqualified men shall not be permitted to operate.

To become a safe surgeon it is important that the individual be properly prepared in theory but in addition it is absolutely necessary for him to work side by side with an experienced surgeon for some length of time. Apprenticeship is vitally essential, and until this positive fact is recognized generally by the profession the task of the College will be a difficult one. But the members must not falter, for human life is at stake.

THE UNIFICATION OF AIMS IN THE HOSPITAL

Rev. Alphonse M. Schwitalla, S.J., Ph.D., St. Louis: The speaker compared the hospital with the human organism in respect to the principles of organization. Developing the analogy he pointed out that in the organism no single organ is allowed unmeasured freedom in its development. The heart, the kidney, the nervous system, any one of these fall into place during the normal processes of the individual's development; likewise the best hospital is not that in which each department is striving for its best possible development but is that in which the parts are developed in relation to the capacity, the resources, and the service of the whole institution.

This unification of administrative aims of the hospital can be brought about only by an integration process. An integration is more than a mere summation, just as the organism is more than heart plus kidney plus nervous system and is rather a unified reality in which most complicated relationships, some of them synergistic, others antagonistic, and some neutral, have been effected among the various organs. These processes of growth and subtraction are causing continual changes in the organism. In the same manner, one part of the hospital cannot grow without affecting other parts, and this general growth in turn is reflected upon the initiating department, imparting to the latter a new vigor that once more reacts upon the remaining departments. This interplay is seen, for example, when a new record librarian, possessed of broad vision and energy, so conducts her department that there is a complete revival of the entire hospital, or when the addition of a school of nursing causes the complete rehabilitation of an institution.

This principle of integration is seldom set forth in the hospital's rules, however. A study of such rules reveals excellent ones drawn up for the institution as a whole and also for the various departments but few regulations applying to the relation of one department with the others. To assure the necessary integration of the pathology department, for instance, with the whole hospital, a rule should be written for the admission officer concerning the department of pathology, for it is he who must frequently inform the patient of adjunct charges and must explain the purpose of laboratory work. Regulations concerning the pathological laboratory must

also appear in the floor supervisor's rules, in those of the surgical department, the medical staff, the X-ray department, the outpatient division, the social service department, and the record room.

OUR CHALLENGE—HOW SHALL WE MEET IT?

PAUL H. FESLER, Minneapolis: The responsibility of conditions existing in hospitals, medical schools, nursing, and public health rests primarily upon those responsible for the administration of the national medical organizations.

The first challenge to the medical world was the Flexner report on medical education, the results of which are history. As a result of commercialism in the medical schools has been done away with, the graduates practice modern medicine, and the death rate has been reduced. Medical laws in most states have been revised to meet the standards of medical schools, and in a few states basic science laws have been adopted. The success of this program depends entirely upon the unbiased, fearless attitude of the Council on Medical Education of the American Medical Association.

The second challenge to medicine was the standardization program of the American College of Surgeons. These standards have controlled medical practice in hospitals. The movement has been most successful in large hospitals, but it is significant that small institutions have not improved as they should. If this challenge is to be fully met, the medical organizations must foster legislation to enforce these fundamental standards in small hospitals. The Fellows of the College are in a position to influence such legislation in their local communities and also to aid their local hospital superintendents in meeting the conditions of standardization.

Improvement in medical education and in hospital facilities has been a factor in increasing the cost of medical care. The result has been the formation of the committee on the costs of medical care, the studies of which when completed will challenge the medical organizations to face the facts presented and to form unbiased conclusions from them.

The report of the committee on the grading of nursing schools, which shows that there is a great oversupply of nurses and that the earnings of nurses are low but that the cost of nursing is too high for the patient, offers another challenge. It appears that there should be two types of nurses: one group for the usual service and another for the specialties and for teachers and executives. The first group would be trained in the average hospital and the second in teaching hospitals. This is a challenge that must be met by those responsible for medical practice.

Finally, the Children's Charter of the White House Conference on Child Health is a challenge to the medical groups to organize prenatal clinics, mental hygiene projects, clinics for periodic health examinations, and to develop a complete program for child health and welfare.

Each of the national organizations representing organized medicine should create committees to study from the standpoint of its own members the reports and conferences of the type mentioned above. Similar committees should be created in the states and in local communities, all for the purpose of promoting co-operation among the national groups, eliminating duplication of their functions, and maintaining the fundamental ideals of medicine. If there is found to be duplication of effort then a joint group should agree on a program which will be of the greatest value to the public.

THE SIGNIFICANCE OF THE SEEMINGLY INSIGNIFICANT MATTERS IN HOSPITAL MANAGEMENT

DONALD GUTHRIE, M.D., Sayre, Pennsylvania: As a rule the patient has full confidence in the hospital's medical service, but strict attention to minor details is important if he is to be satisfied and made a loyal supporter of the institution. To give these minor matters the attention they deserve requires the constant and friendly understanding of the superintendent, the directress of nurses, and the medical staff. Too often those in positions of authority are more concerned with what, to them, are weighty matters. The superintendent spends much of his or her time devising economies to be reported to the board of trustees. The directress of nurses gives most of her attention to the prescribed curriculum of study which, by the way, has made necessary the overstaffing of hospitals with nurses and is fundamentally the cause of much of present unemployment among the nursing profession. The medical staff is more concerned with the intriguing morbid pathology of the patient than with his mental reactions.

It is the spirit of the hospital that the patient remembers long after his illness is forgotten. This spirit is manifested at the very entrance. The doorman, for instance, is an important member of the hospital group and he should be an astute student of human nature. Admission clerks also should be chosen for their ability to deal tactfully with worried and confused patients. While waiting to be taken to the ward or his room, the patient should be spared unpleasant sights and sounds. The patient should be made to feel that his interests are being looked after carefully and that he is not being neglected in any way.

The problem of telephone service is important, and not only should the operator be alert and well-trained but she should be supplied with correct information from the medical staff about patients who are critically ill. This information should be sent to her after early morning rounds.

New patients should not be placed beside those in an extreme state of illness. The hospital should be equipped with recovery rooms, small wards, and isolation corridors for the postoperative, the very ill, and the delirious patients. Patients who have been operated upon should not be moved into the ward until they are free from pain, and no painful dressings should be done in the ward, nor should a death be allowed to occur in the ward.

If a complaining patient is noted by the pupil nurse, he or she should be reported at once to the nurse in charge and the complaint should be investigated and, if just, remedied. If there is no basis for the complaint, there should be a concerted effort to win the patient by kind attention. This failing, he or she should be moved from the ward.

Nurses should be trained to wait on patients promptly and to give them every attention, as delay in answering calls is apt to seem longer to the sick person than it actually is. Too much care cannot be taken in listing and in looking after the patient's clothing and valuables. A patient easily forgets that his life has been saved and flies into a rage over the loss of his hat.

Good hospital morale demands loyalty on the part of the nursing force and the medical staff to the chief on duty. Dissatisfaction on the part of the interne is extremely dangerous and spreads quickly to the patients. Internes should be taught to receive their patients with every consideration, and their good work should be rewarded by increased confidence. The nurse should be instructed to make allowances for the patient's disposition because of his illness, and she should be taught the value of a pleasant manner. The orderly presents a serious problem. He should be paid a much better salary than is paid him by the average hospital. Often an operative patient has been nursed through a grave crisis only to leave the institution embittered by the rough and inhuman treatment of an uncouth orderly.

Good food, well cooked and served attractively, is a great asset to any hospital. It is better to apply economy to everything else in the hospital than to the table. Food should be the best that can be bought, and there must always be enough, but servings should be dainty.

It is important to have the friends and family of the patient feel that the hospital is anxious to serve them as well as the patient in a kindly manner, and for this reason signs such as those commanding silence do more harm than good. During times of great anxiety all visiting rules are best suspended. Families of the very ill patients should be allowed to stay with them, to spend the night if necessary, and their comfort should be provided for. The business office should be considerate in its treatment of a bereaved family, and it is well to wait some time before sending statements.

In the operating room there should be the same regard for details. If anæsthetics are skillfully given there will be little fright, little nausea. A successful anæsthetist must be a skilled psychologist. At the completion of the operation the patient should be lifted from the table and transported back to bed by members of the operating team, not by an orderly.

If hospitals could be robbed of their cold institutional atmosphere, if the patients were treated more as individuals and less as cases, if the management and nursing force would co-operate better with the staff in planning for the patient's welfare, there would be much less criticism.

THE PRESENT STATUS OF HOSPITAL COSTS AND CHARGES—REPORT OF A NATIONWIDE SURVEY

JOHN A. MCNAMARA, Chicago: A study of 730 general hospitals of 25 or more beds was made with a view to determining the present status of costs of operation, charges to patients, and percentage of occupancy. In order to determine the economic conditions in hospitals depending almost solely upon the support of the public, federal institutions were not included.

The average cost per patient per day was revealed as $5.33 for the year 1930, a figure that compares with $5.32 for approximately 1,100 hospitals studied in 1928 by the American Hospital Association, and a figure of $5.30 for 1929. This lack of variation is surprising, especially because food and labor costs have decreased materially since the 1928 and 1929 studies were made. But it may be that these factors are counterbalanced by the lowered occupancy reported and possibly by the increased service demanded by patients.

Forty-five Catholic hospitals in the group showed an average cost of $4.20, a low figure accounted for by the fact that much of the service is voluntary and these institutions are relieved of one of the large items of expense, salaries for executives.

Costs in individual hospitals were sometimes as high as $9.00 per patient per day, and in certain municipal hospitals, less than $2.00 a day. Those showing high costs were frequently teaching institutions, and hence part of the amount should be attributed to education, and a number were in California where hospitals are taxed and hospitalization is on a more elaborate scale. One hundred and sixteen hospitals reporting on the differences of costs for wards and for private rooms showed an average of $5.92 for the latter and $4.17 for ward service. No averages were determined for the charges to patients because it was found practically impossible to figure them on the basis of the answers sent in. Since some hospitals charged as high as $20.00 a day for private rooms and others as little as $2.50 a day, it was thought that any averages would be misleading.

Figures on occupancy for 1930 showed only a slight decrease as compared with the previous year, the average being 68 per cent for 1930 as contrasted with 69 per cent for 1929. The average for 1926 was 65 per cent; for 1927, 67 per cent; for 1928, 68 per cent. A number of county, state, and municipal institutions, however, showed a great increase for 1930, in one instance, as high as 102 per cent. If these were excluded a much greater decrease would be noted among the private hospitals.

Reporting on sources of income, 552 hospitals showed on an average that 23 per cent of all their work was classified as free, 22 per cent as part-pay, and 55 per cent as full pay. Only 124 hospitals in the group are members of community chests, and only 26 reported any aid from churches, although a large number of them are church hospitals. Seventy-five per cent of the 245 hospitals that reported endow-

ment funds are in the 14 states east of the Mississippi River and north of the Ohio River. The idea of endowments does not seem to be popular or perhaps to be understood in the southeast, southwest, and northwest portions of the United States, possibly because of the sparsity of population and because of the large number of doctor owned hospitals in these localities.

Eighty-four per cent of the hospitals stated that they maintained out-patient departments but only eight institutions stated that they had a connection with a hospital for convalescents. Most hospitals reported that their facilities were used by physicians in the examination of patients in their private practice, but few stated that extensive use was being made of such services. The trend, however, is definitely toward the physician having his office at the hospital. The questionnaires showed that few hospitals made surveys to determine whether or not they were meeting community needs.

Discussion

C. W. MUNGER, M.D., Valhalla, New York: Hospitals deriving support from private funds may experience major difficulties in balancing their budgets, due to the added free service and the decline in income from paying patients. It seems quite proper that public tax funds should assist private, nonprofit community hospitals in accordance with their needs and the public service they render.

At recent hospital meetings the question of reduction of salaries has been discussed and the general conclusion has been against cuts which would reduce efficiency. A program of economy should not be extended to the point where essential standards in the proper care of the sick must be sacrificed.

THE STAFF CONFERENCE ASSURING A THOROUGH REVIEW OF THE CLINICAL WORK

ALTON OCHSNER, M.D., New Orleans: Too frequently hospital medical staffs comply with the letter of the requirements of hospital standardization that pertain to clinical conferences but do not enter into the intended spirit. A staff conference in order to be successful must be well organized. The program should be prepared at least one month in advance of each meeting by a committee of enthusiastic staff members. If feasible, the various departments should be represented on the program committee.

Another essential is the choice of a suitable chairman. The presiding officer must have the respect of the entire staff and should, as a rule, be one of the senior members. He should also have considerable clinical experience in order to be able to evaluate the facts presented concerning individual cases, especially fatalities. He must possess a great amount of tact and should be able to rise above petty jealousies, especially during a consideration of the fatal cases. The superintendent, because of his administrative ability, if he satisfies these requirements, would make an ideal chairman for staff meetings.

A regular and full attendance at staff meetings is not only desirable but also essential. This may be accomplished by having the programs so interesting and instructive that members will not want to miss a meeting, by instilling a sense of loyalty so that the staff will attend because they feel it their duty, or by imposing some form of penalty for absence. Unless the conferences are made attractive enough so that staff members will attend voluntarily, little interest will be taken in them. Posting attendance records in a conspicuous place is of some help in increasing attendance but should not have to be done except as a last resort.

Analysis of the fatal cases is one of the most important phases of clinical conferences but far too frequently is only perfunctory. Each death should be considered separately and a free discussion conducted in an impartial, scientific manner. There should be complete information on every case, particularly that obtained by postmortem examination.

The following methods of conducting discussions are used successfully today: (1) A week before the meeting abstracts of the cases are given to two members of the staff, neither of whom has seen the case and whose only interest in it is scientific. These two persons open the discussion and this is followed by general comment, without any reference to the attending physician. Laboratory findings are presented, including the report on the pathology, which is given by the pathologist himself. The discussion is closed by the chairman, who reads a summary of the case, including the final diagnosis and treatment. (2) The facts concerning the cases are presented by the physician in charge, without any mention of the ultimate findings, the final diagnosis, or the treatment, and then general discussion takes place. With this method the staff are more apt to discuss the case impartially because, being unaware of the ultimate findings, they cannot be accused of destructive criticism. After general comments by staff members the remaining details, including operative and necropsy findings, are presented by the attending physician. (3) The clinical findings, all important laboratory data, and the report on the pathology are presented by the chairman, who also opens the discussion. The chairman, in such an instance, must be an exceptional individual, since he must not only have had extensive clinical experience but must also be fair in his judgment. His comments are followed by general discussion. (4) The clinical findings, which should include laboratory data and the necropsy findings, are presented by the pathologist who, in an impartial way, states the facts. This information is then discussed very frankly by the staff with the sole purpose that everyone may profit by the case.

The report of critical studies of the clinical results obtained in the hospital is also a desirable feature of staff conferences. Without such searching analysis of end-results, there can be little reliable knowledge concerning the efficacy of the various forms of therapy. Material of this nature is also of educational value to individual members of the staff.

The use of visual methods in presenting data at clinical conferences is highly commendable. They are especially valuable in the presentation of the anatomic lesion, both gross and microscopic.

Discussion

ALLAN CRAIG, M.D., Torrington, Connecticut: It is sometimes a mistake to have the superintendent act as presiding officer at the clinical conference, for the reason that a considerable percentage of administrators are laymen or nurses and not competent to preside at a scientific meeting. The duty could better be taken over by the chief of staff. The need for care in preliminary preparation of conferences should be stressed and the program should be divided into consideration of the work of the various clinical services, the medico-administrative problems, and the findings and conduct of the clinic for periodic health examinations. There is danger of the staff conference being given over simply to the discussion of institutional deaths. The death which is considered without postmortem findings loses a large percentage of its value as a source of information, since the ultimate conclusions are not backed by facts.

IMPORTANT FACTORS IN ASSURING EFFICIENT NURSING CARE OF THE PATIENT

JANET FENIMORE KORNGOLD, R.N., New Orleans: Probably more than by any other influence, the quality of the patient's care is determined by what the nurse has been taught. In planning a program of nursing education it might be well to consider the kinds, frequency, and persistency of errors made in bedside nursing. Such an analysis shows that mistakes in nursing fall into three main categories: (1) those relating to manual skill, such as inability to give a hypodermic injection deftly; (2) those in the observation and reporting of symptoms, such as failure to know when shock or collapse is imminent; and (3) those arising from inability of the nurse to adjust herself to a given situation. Probably more errors are due to deficiencies in the nurse's personal equation than to either lack of manual skill or power of keen clinical observation.

Studies made by the committee on the grading of nursing schools bear out these findings in studies which show that physicians and patients both demand the same sort of abilities in nurses and both are vexed by the same three types of errors mentioned.

Manual procedure is easily mastered and hence nursing education need not devote a long course to this sort of instruction, but schools are weak in teaching which is calculated to develop powers of observation. This is because instruction is practically all limited to the classroom.

Another weakness in nursing instruction is that the curriculum is heavily academic, and many of the lecturers never touch upon any of the faults in nursing which they themselves deplore. Chemistry, physics, bacteriology, and pathology occupy increasingly prominent positions in the courses offered by many schools. Yet it would be difficult to demonstrate in what way technical laboratory work in the sciences improves either the nursing ability or the nursing personality.

In planning the educational program more thought should be given to the nature of the work student nurses are being prepared for. Good nursing is more akin to the arts than to the laboratory sciences. To steep herself in literature, history, and biography will do the nurse more good than to wrestle with experiments in electrolysis and equation writing. The emphasis in nursing education could well be shifted from things technical and diagnostic in their significance to things more human and closer to the nurse's sphere of activity.

A PLAN FOR THE SYSTEMATIC INSTRUCTION AND SUPERVISION OF INTERNES AND THE RESIDENT STAFF

HAROLD L. FOSS, M.D., Danville, Pennsylvania: The interne is expected to perform such numerous and varied tasks as writing histories, making physical examinations, assisting in the operating room, treating dispensary cases, aiding in the preparation of bibliographies, and carrying on research, the speaker pointed out. The interne frequently spends 50 to 60 hours of hard work each week, often exceeding, in point of actual time spent, the efforts of the average laborer. These many services help to place the medical staff under definite obligation to him, particularly to aid in his training.

The interne year is no time in which to permit the young doctor to shift for himself, for at this period more than at any other time it is essential that he be under sympathetic supervision. Because in far too many hospitals no definite schedule is followed, a plan of interne training along the following lines is recommended.

One of the chief essentials is that the senior physicians establish close contact with the internes. The hospital superintendent has an obligation to see to it that the chiefs of service not only make the customary rounds with the internes but also establish sympathetic, friendly relationships with them.

The resident staff should not only be welcome at the monthly clinical conferences but perhaps should even be required to attend. In addition, there should be a weekly staff meeting especially for the internes, usually under the direction of the chief resident or a member of the senior staff. Each interne should present at least one paper annually before these meetings. Every week there should be demonstrations in roentgenology, clinical conferences, diagnostic clinics, and similar educational programs directed by the department heads.

One of the most valuable means of instructing internes is the clinico-pathological conference. At this meeting slides of both the gross and microscopic pathology should be shown. All members of the interne staff should be present at the conferences. A well balanced program of seminars, lectures, and

demonstrations, to which each chief of service devotes a certain amount of time, should be arranged as part of a conscientious effort to instruct the internes. Every interne should also be given problems of research, probably not more than one a year.

Hospitals near teaching institutions are in a position to arrange for frequent evening lectures participated in by members of the faculties of neighboring universities, programs which are profitable for the entire hospital organization.

During such an interneship in which work in the wards, operating rooms, and laboratories is supplemented by seminars, conferences, demonstrations, and research, the young graduate acquires a fairly comprehensive knowledge of general medicine and develops a sense for scientific work. Men going into specialties and internes who are outstanding in their abilities should be encouraged to continue their studies.

An urge to undertake surgery is being too frequently experienced by recent graduates. As a result too many young doctors are advising unnecessary operations and are attempting surgical work they are quite unable to perform successfully. Present educational requirements with their severe demands in time and money, the necessity for the graduate to support not only himself but possibly also a family when he has completed his interneship, and the present economic stress are all factors tending to the adoption of short-cut methods in the period of preparation between graduation and entering upon practice. Many of these young doctors undertaking surgery without proper training never become fully aware of their incompetency.

Before an aviator may make a solo flight he must demonstrate to a federal officer that he is thoroughly competent to take his life in his own hands, but any doctor who possesses a state license, which is no evidence of surgical ability, can without any restriction take into his hands all the other lives he may wish. That some further restrictions than now exist are necessary cannot be doubted. The American College of Surgeons has before it a problem the solution of which it is in a position to accomplish more than any other agency in this country. If it can succeed in correcting this outstanding evil, it will make even a greater contribution to American surgery than it has in its splendid work of hospital standardization. In any event, it will be in the hospital and with the resident staff that the chief effort will have to be made.

Discussion

T. Dwight Sloan, M.D., New York: What the interne most desires is to be closely associated with men of outstanding professional ability in order that he may learn from them how best to examine, diagnose, and treat patients. It is this direct and expert guidance of senior men of high reputation that constitutes the chief attraction of an interneship. Given this, the interne and the resident will gladly avail themselves of all the extra aids to training, such as conferences, clinics, and research problems. It is obvious, therefore, that there is a great responsibility resting on those who direct the systematic training of the internes and residents and also that there is a corresponding opportunity for the attending physicians to multiply their usefulness through the influence they exert upon the younger men.

ADMINISTRATIVE AND ECONOMIC PROBLEMS ASSOCIATED WITH THE "OPEN" HOSPITAL

Frank J. Walter, Denver: It is with the larger number of doctors having the small number of patients in the open hospital that the greatest problems arise. This group manifests less loyalty to the hospital and less deference for its rules, the economy of supplies, the program of education and research, and the standing of the hospital in the community, than is usually shown by members of a staff in a closed hospital.

Studies show that most of the general hospitals have staffs which might be termed open, but from another point of view might be considered closed. Their organization consists of a more or less select group of physicians who hold regular staff membership, and in addition a large number of doctors classified as associate or courtesy members, and sometimes also a consulting staff. This means that the actual voting staff is the closed part. The open staff, in the sense of admitting doctors indiscriminately, seems to be a thing of the past in all standardized hospitals. The open hospitals must have some regulations which will enable them to bar physicians not in good standing without making the institutions liable to lawsuits for damages on the part of barred doctors.

A well regulated open hospital better serves the community and the patients as a whole, while the closed one perhaps better serves an individual group of doctors and their respective patients. In a large community there is a place for both the open and the closed hospital, but in the small community it is almost imperative that there be at least one open or semi-closed hospital. The policy of allowing every ethical physician hospital privileges might seem too liberal, but the contact of mediocre doctors with the hospital's resources and the more skilled physicians may lead the former to improve the quality of their work.

Another problem of the open hospital lies in the fact that staff conferences are frequently less well attended than those of the closed institution. Due to the physicians' lack of responsibility to the open hospital it is harder for the latter to secure co-operation in obtaining autopsies, and because of the few and irregular visits made by some physicians, it is more difficult in the open hospital to train the courtesy staff in the making of complete clinical records.

Because the patient-day census fluctuates more in the open hospital and it is, therefore, difficult to utilize the personnel most efficiently, the open hospital's cost per patient day is greater than that of the closed hospital. The closed hospital usually leads to

a more active organization on the part of the staff, resulting in greater efficiency in operation and making it easier to effect certain recognized techniques for all standard procedures. The various individuals practicing in the open hospital have their own techniques and thus it becomes very difficult to enforce uniform methods which would tend to reduce the amount of nursing service and supplies used. Another factor increasing costs in the open hospital is that the staff members are not as much concerned about their private patients' ability to pay for hospitalization.

There is a tendency on the part of the open hospital to allow the administrative problems to take precedence over the educational program. In an open hospital it is also more difficult to interest the physicians in aiding with the instruction of internes and student nurses. There is a tendency, too, to neglect the research, for the reason that the average open hospital does not have the funds for such a program and that the diversified interests and looser ties of organization among the physicians make them less prone to undertake this work.

It is virtually impossible for an open hospital to carry on an efficient charity service without delegating that part of its activities to a closed staff. To what extent this problem and the others mentioned exist in the open hospital depends upon the efficiency of its administration and the loyalty of its staff.

Discussion

BORIS FINGERHOOD, Brooklyn: Neither the closed nor the open hospital avoids commercialism or prevents errors or failures. The problem of the open hospital versus the closed has become one of mighty proportions, one affecting not only the medical profession but also the millions of others who are in one way or another affected by the function of a hospital. With scarcely one-third of the 90,000 physicians in the United States maintaining hospital affiliations, it becomes necessary to solve the problem or at least acquaint the public with it.

The advantages of the closed hospital over the open system are generally referred to as follows: (1) the closed hospital is better for teaching purposes; (2) it makes possible valuable contributions to the science of medicine; (3) in it the treatment of the sick is more scientific; and (4) it develops the more proficient and censors the incompetent.

However, closed hospitals are apt to be accused of being controlled by a small coterie to the exclusion of all others and, thus because of the monopoly of power, doctors who could make real contributions are often excluded, to the detriment of the cause of science. The closed hospital does not always perform the teaching function, moreover. Those who are supposed to teach the younger men are often in direct competition with them. Nor does the closed hospital eliminate the use of questionable methods on the part of individuals. Because of its very nature the closed hospital does not always assure the maintenance of proper medical standards, for it does away with the incentives to a healthy and progressive rivalry. It is a question, too, whether the methods of selecting the staff for a closed hospital always insure the wisest appointments. The closed hospital is, then, no solution to the problem. In an attempt to solve it, we must first agree that whatever may be devised must be of advantage to the largest possible number.

By blending the good that may be found in both the closed and the open hospitals, we may arrive at something that will afford every worthy physician a hospital connection through which he will be given the opportunity to attain a higher degree of proficiency. This will inevitably reflect itself in better medical service to the community.

THE PRESENT ECONOMIC DEPRESSION IN HOSPITALS —INCREASING THE UTILIZATION OF HOSPITAL FACILITIES—MAINTAINING THE BALANCE BETWEEN ECONOMY AND EFFICIENCY

C. J. CUMMINGS, Tacoma, Washington: In the business world, times of financial depression may be met by reducing stocks or the price of commodities, decreasing output, or even closing the plant temporarily. Hospital doors, however, can never close, and with the patient's welfare the primary consideration, drugs, supplies, and apparatus, cannot be disposed of; nor in the face of decreasing demands for service is it usually feasible to lower the cost of it.

In an attempt to evaluate those factors which contribute to the decrease in hospital earnings, no nationwide statistics are available and no general conclusions justifiable, but it would appear that some of the problems of a single area may be general throughout the country. A study of a group of hospitals in Washington and Oregon has revealed a loss of revenue beyond that resulting from a simple decrease in the number of patients cared for. The actual decrease in hospital patients as compared with normal times has been as high as 20 per cent. This figure has varied within wide limits, some hospitals showing a greater loss and others relatively less.

Of more importance is the increasing use of the wards and semi-private rooms. In a few hospitals investigated, this has resulted in a reversal of the normal order of things: where formerly 90 per cent of the private rooms were regularly occupied with but 60 or 70 per cent of the ward beds filled, now 70 per cent or less of the private rooms are occupied while the cheaper quarters are filled, or nearly so. It is recognized that greater economy in hospitalization of ward patients can never compensate the institution for a great decrease in the number occupying private rooms.

There is also a lessened demand for operative and special facilities. The number of operations shows a decrease, compared with 1929 and earlier, of about 20 per cent, and a similar reduction is observed in the use of services offered by the clinical laboratory and the X-ray department.

Increasing difficulty is noted in making collections, and the so-called bad debts have shown an increase

in number for the year 1930. It is also found that arrangements are more frequently asked for future payment.

As one of the means of partially compensating for such losses, the pay of more hospital employees might be adjusted to include their maintenance. Employees would thus be receiving substantially the same amount as previously and the hospital would save through quantity buying and utilization of the same kitchen personnel in preparing the larger number of meals that would be required.

Few hospitals will be able to effect extensive economies in heat and power, although in some areas it will be possible to use a cheap waste fuel. Study of the handling of hospital linen shows that the use of the outside commercial laundry may add a considerable financial burden because of losses in articles and failure to make repairs promptly. In some hospitals, the saving from having the laundry done in the institution amounts to 1½ to 2 per cent of the gross earnings. The hospital's department of salvage and manufacture may also effect economies, particularly by reclaiming old linen and making up new articles.

A factor of real importance in the economical running of the hospital is the substantial decrease in the cost of certain hospital commodities, particularly food, which shows a decrease of about 20 per cent in 1931 over 1929.

A reduction in the charge for private rooms is not advisable as there is real economy in having them empty rather than filling them at reduced rates. Should conditions improve and the rates be raised on private rooms once lowered in price there would be resentment on the part of patients readmitted, who had previously paid the lower rate.

In some instances, the closing of nurse training schools might make for economy, but it is quite likely that no changes will be made for the sake of any economies that might result.

Decrease in the collection personnel is false economy. Moreover, the hospital should maintain its own collection department as no commercial agency can understand the hospital's collection problems as well as persons on its staff. Reduction in the pay of hospital employees should be instituted as a last resort, when all other expedients promoting economy have been exhausted. Substantial as may be the saving effected in this way, it proves small in proportion to hospital costs as a whole.

FACTORS TO BE CONSIDERED IN THE COST OF MEDICAL CARE FROM THE STANDPOINT OF THE HOSPITAL

WILLIAM H. WALSH, M.D., Chicago: All the reliable data concerning the costs of illness point to the following fundamental facts: that the largest share of the total outlay for a given number of families falls upon a small proportion of the total; that sickness insurance has not yet been worked out on a practical basis; that the average expenditure per person decreases with the size of the family and hence indicates that those of larger families either do not receive adequate medical care or use clinic services; that the average family and the average individual cannot afford to pay the prices now charged for adequate medical and hospital care; that neither the average physician nor the average nurse appears to earn an excessive income; and that an appreciable amount of the charge made for hospital care is not properly chargeable to the care of the sick, such charges, for example, as the cost of nursing and medical education.

Several factors contribute to the cost of hospitalization. One of these is that there are too many separate hospitals in too many communities, thereby increasing tremendously the overhead. The complete elimination of some hospitals and the consolidation of others would increase efficiency.

No hospital can render adequate service and make a profit at a price within the means of the patient of moderate income. Other causes of high costs are waste of space, ostentatious display, poor designing, and defective engineering in hospital plants, also the fact that there is much expensive equipment purchased and not used.

As a measure to reduce hospital charges to persons of moderate means, accommodations should be provided to suit the patient's economic status. The practice of overcharging the pay patient, without his knowledge or consent, is indefensible. The hospital world should formulate a policy to the effect that the rate to private or semi-private patients would be based on the cost of accommodations and service used plus a reasonable charge to cover bad debts and obsolescence; that the rate for part-pay patients would be based on the cost of accommodations and service, less an amount to meet the patients' ability to pay, the difference to be made up from endowments or taxes and under no conditions by overcharging other patients; and that the cost of full charity patients would be met also by contributions or taxes. Workmen's compensation cases cannot be considered as charity cases and should be a charge against the industry concerned.

Nurse training is not a just charge against the sick and should be borne by the community, in the same manner as other educational projects. Group nursing has proved successful when properly regulated, both from the standpoint of adequate and economical care of patients and that of the income of the nurses.

Inefficiency on the part of hospital superintendents is often responsible for high costs of hospital service. There is a crying need for a standard qualification rating for superintendents, and there should be some national agency to pass upon and approve those who are qualified.

Co-operative buying among hospitals, more institutions for the care of chronics and convalescents so that patients not acutely ill will not have to pay the necessarily higher cost for beds in hospitals for acute illness, avoidance of unnecessary hospitalization, and greater efforts at leadership on the part of eminent

administrators are other means of reducing hospital charges.

WHAT SHALL WE DO ABOUT AUTOMOBILE ACCIDENTS—REPORT OF A NATIONWIDE SURVEY

MATTHEW O. FOLEY, Chicago: Between five and six million dollars are lost annually by hospitals in serving victims of automobile accidents, according to the speaker's estimate. As a result of safety efforts, accidents involving vehicles operated by corporations decreased sharply in 1930 as compared with 1924, but mishaps involving private cars were nearly half again as great. The difficulty of locating and dealing with owners of private cars increases the collection problem for hospitals. The fact that vehicle collisions are growing eight times as fast as pedestrian accidents also means delay in collection of hospital accounts inasmuch as it is more difficult to place the blame in the former type of accidents.

The hospital field has no figures of its own to show the size of the problem of making collections from victims of automobile accidents. The first study made was that of the Ohio State Hospital Association, which showed that 122 hospitals surveyed in that state lost on an average $36 per patient in treating those injured in highway accidents. A more recent study in New Jersey showed that 19 general hospitals suffered an average loss of $26 on each of such patients.

The speaker stated that he had requested information of like nature from general hospitals in every state but was impressed with the almost complete lack of attention paid to the subject by hospitals. Figures for his paper were obtained from 30 states and dealt with the hospitals' experience in treating a total of 21,740 patients, 12,347 of which required bed care. Hospitals reporting a total of 10,797 bed patients stated that of these, 3,851 had paid their bills in full. Of 7,621 first-aid patients treated, 47 per cent paid in full.

The typical hospital caring for a large percentage of patients injured by automobiles finds that they increase the average length of stay. About half the hospitals estimating the amount of service required said that 30 per cent or more of such patients needed long hospitalization.

A number of hospitals did not segregate patients injured in highway accidents from others, and apparently did not regard such cases as a problem. A majority, however, said they believed the situation arising from automobile accidents was a serious one. A very few hospitals looked for the automobile accident patient to pay his bills just as readily as any other type of patient. Those institutions reporting only small losses from this source have, in some instances, a rule that first-aid only shall be given to accident victims, while certain others routinely admit all these patients to the wards unless they pay in advance the usual charges for other accommodations.

Five types of laws designed to help hospitals minimize loss from automobile accident patients are now in effect. Several states have lien laws offering the hospital a claim on any damages that may be awarded a patient injured in an automobile accident. The Connecticut law particularly has been used with good effect, it is reported.

Compulsory liability insurance is also used as a method to compel payment. One of the largest hospitals in Massachusetts, where such a law has been enacted, reported, however, that, the act has been the cause of a larger number of accidents due to increased recklessness inasmuch as the driver feels that damages will not be assessed against him, and that such a law is no guarantee that a hospital will receive payment.

A West Virginia law gives taxed hospitals credit to the amount of service rendered to all indigent patients. The law which seems to have worked to the best advantage of the hospital is that Indiana statute which makes it necessary for the township trustees to determine whether or not a patient is a pauper and to see to it that the hospital is reimbursed for the care of indigents.

A fifth law is that designed to protect hospitals against fraud. It is similar to the hotel laws of that nature, but does not apply specifically to automobile accident patients. A hospital administrator in Connecticut stated that this law together with the lien law made it possible to collect from virtually all patients admitted up to September 1 of this year.

No law thus far fully protects hospitals in every automobile accident case. Hospitals should, therefore, gather and analyze all facts connected with automobile accident service and join with other agencies interested in any phase of the problem relating to automobile accidents, for the purpose of reducing accidents and all forms of loss.

HARMONY, EFFICIENCY AND COMMUNITY GOODWILL IN MANAGING THE HOSPITAL

ROBERT JOLLY, Houston: The proper relationship of the superintendent to the governing body, the personnel, the medical staff, and the patients was discussed.

The relationship of the superintendent to the trustees should be that of enlightening them and enlisting their aid. He should keep them informed of the financial condition of the hospital and should report to them on the scientific work. It is especially desirable that the trustees be enlightened as to the requirements of the minimum standard so that their assistance can be obtained in making the hospital worthy of approval. The more trustees know about the hospital the easier it becomes to enlist their aid. If the administrator desires to obtain their support he should honor them with special duties and should challenge them with difficult and important tasks.

The attitude of the superintendent to his subordinates should be fraternal and frank. It is worth while to cultivate an atmosphere of friendliness, to stress the "family spirit." Some institutions even seek to protect the future of their employees by means of insurance. The administrator must learn to find and emphasize the fine qualities in an indi-

vidual, for in so doing he will stimulate that person to do his best. It is sometimes found helpful to make special mention in conferences of those who have done exceptionally well in any work. When the superintendent has been liberal with his commendations it is then not so difficult to point out faults, and criticisms will therefore be received in a good spirit.

The director should study the individuality of each staff member and make it his pleasure to see that every physician is as nearly satisfied as possible without relaxing the rules of the institution. Instead of making rules and then trying to enforce them, the superintendent should induce the staff members to make the rules and call upon him to see that they are observed.

Patients are usually the first to sense a lack of harmony and efficiency in the hospital. Even before the administrator finds that there is a flaw, the patient will have discovered it by conversations with nurses and others or simply from the atmosphere of dissatisfaction. A superintendent will do well to come in contact with his patients frequently and to catch their reactions.

If the superintendent has harmony and efficiency among his hospital family, he already has two mighty forces to aid in securing community good will. But in addition to satisfied patients he will want such other means of eliciting good will as newspaper publicity, magazine articles, a hospital paper, radio address, and community health meetings. Five free health forums were sponsored by the Baptist Hospital, Houston, during the year, and the consensus was that they were one of the most successful means of benefiting scientific medicine and the hospitals.

When the public has been informed of the activities and services of the hospital, it is not difficult to inspire them to befriend the institution, and the very act of giving will increase their good will.

THE GENERAL ORGANIZATION AND SCOPE OF SOCIAL WORK IN MEDICAL INSTITUTIONS

M. Antoinette Cannon, New York: The scope and function of medical work center in an attempt to understand and deal with the social component in disease. The idea that there is a social element in disease is a concept relatively little used.

A social component in a health problem does not necessarily mean a social cause of a specific illness. The subject of cause has proved too difficult to allow any clear conclusions except perhaps in the field of psychiatry and of public health. It is evident, however, that social situations and personal qualities condition response to treatment and therefore social study has been found of use in connection with prescription and prognosis. In the carrying out of medical directions and the organization of the social situation, the social worker's relationship with the patient as a person may play a part in getting a result. When the social element enters in, knowledge of anatomy and physiology is not enough for prognosis.

The following principles might be used as a guide as to the scope of the medical social worker:

1. The medical social worker should be able to make a thorough social study and to carry social treatment to a conclusion.
2. In general, it is better that the agency prescribing should provide for carrying out the treatment. This means medical social relief and medical social case treatment.
3. To the special agency should be referred the appropriate special problem for diagnosis and necessary treatment, not for the carrying out of orders.
4. When two or more agencies are working together on a case the decisions and plans should be made jointly and the part of each agency should be understood by both.

Concerning the question of whether the hospitals should endeavor to do something for every patient or try to do the best for the few who chance to come to them, it would seem that both the quantitative and the qualitative standard should be upheld. There should be a routine social inquiry as a basis for choosing cases for social study and treatment. If the doctor, rather than the social worker, is to make the social history, along with the medical, he ought to be better prepared than are most physicians at the present time.

The undesirable practice of having hospital social service departments administered from outside the institution is tending to disappear. The practical difficulty in relating social work adequately to medical is that the social service staff is relatively small and thus must serve two or more masters. The best form of organization seems to be to have social workers adequate in number to cover the needs and to assign them according to the division of medical service.

The hospital is the strategic place where medical social processes may be used in the interests of the patient and where they may be combined in a study of the interrelation of medical and social conditions for the ultimate promotion of good health, good social behavior, and a good social order.

MEDICAL SOCIAL WORK IN INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

Louise C. Odencrantz, New York: An indication that a considerable number of persons find it difficult to return to former employment once they have sustained a physical defect is the fact that in the first 3 years of the existence of the New York Employment Center for the Handicapped, some 9,500 applicants registered. Employers co-operated to the extent that 5,800 placements could be made. The need for careful study of the applicant is shown by the fact that of the total number seeking work, 13 per cent were found not only to be unsuited for placement in industry, but were in further need of medical attention, institutional care, or were hopelessly handicapped.

The difficulties which both physicians and social workers often encounter in compensation cases, in spite of the most expert medical work, are often traceable to a disregard of the patient as a whole, to

the effect of the accident upon the patient's mind, to the feeling of insecurity about his future, or to the exaggeration or underestimation of his condition by conflicting interests, and finally to the fact that constant emphasis has been placed upon his handicap so that his condition becomes the dominating interest in his life.

The analysis of the problem of vocational adjustment needs the case work approach in the application of the techniques of vocational guidance and a special knowledge of the kinds of work that may be suitable for persons with various kinds of handicaps, of the resources for retraining, of the possibilities for placement within the industry.

When the patient is ready for placement he often meets a new set of obstacles in the social attitude of ostracism. A primary difficulty, especially as regards the larger companies, is the physical examination at entrance, which usually bars those with physical defects even though the latter are such that they will not interfere with satisfactory performance of duty. A few companies have begun to adjust their physical requirement so that an applicant's physical fitness is measured in relation to the particular work he is to do. Objections are raised that employment of persons with physical defects may lead to higher compensation insurance rates. This is not always true, since the liability in some states is limited to the extent of the second injury only. The objection is met also that a person with a handicap demands special consideration.

In order to overcome some of these obstacles there is need of an intermediary, some one who understands the abilities as well as the limitations of the persons with physical defects and on the other hand who knows industry and the requirements of the individual job, and who can interpret one to the other. Medical recovery is a job only partly done until vocational rehabilitation is effected. The co-operation of the medical social worker and the physician in a constructive program for the physically handicapped is the best method by which to enlist the greatest factor in recovery, "the co-operative participation by the patient in the care of his own health."

Discussion

MISS JANE THORNTON, New York City: Medicine is a long way from accepting responsibility for treatment of the "whole man" rather than for some ailing part. A good case is made out for resisting the tendency to thrust upon the physician responsibility for services formerly thought of as the field of the pastor, teacher, or parent. The basis and development of social service, however, is profoundly affected by the degree to which the "whole man" policy prevails in a medical institution.

Hospitals are spending many thousands of dollars to repair damages of disease and injury but are turning out the partially rehabilitated, who find there is no place for them. Opportunities for the handicapped are being reduced because of the extreme cautiousness of employers, hospitals among them. But it is encouraging to note that even a few large companies are discovering that physical fitness is not the whole answer to fitness for a particular job.

The problem of estimating the patient's ability or disability is not given the attention it deserves. There are physiological tests to determine capacity for different types of activity and psychological tests for determining aptitudes, yet it does not appear that these tests are employed in clinic or hospital care. Such scientific methods should be worked out, however. For the present the social worker must seek to contribute all she can by her detailed study of the patient. If possible the physician should give the social worker a correct estimate of the handicapped person's ability to engage in some line of work.

SOCIAL SERVICE AND CANCER CONTROL

GEORGE H. BIGELOW, M.D., Boston: Cancer control with present knowledge depends upon three simple principles: the removal of all possible sources of chronic irritation, early recognition of the disease, and prompt administration of adequate therapy.

The social worker as an informed member of the public should pass on her knowledge of the etiological factors in the disease. In the field of early recognition she must be familiar with all public and private resources for service in the diagnosis of cancer, and she must know of the simple, early signs sufficiently clearly to transmit motivatingly to her clients. The general public, too, should be expected to have an intelligent knowledge of the simple, early danger signs of all important diseases. This knowledge, as some suppose, will not breed hysteria, for the latter breeds in fallacy, not fact.

Hospital admissions for cancer have increased 30 per cent in Massachusetts over the past 5 years, probably due to the increasing cancer-consciousness among physicians, more active responsibility on the part of state hospitals in making their resources readily available for service to cancer patients, and greater willingness of the public to make use of these resources.

When a diagnosis of cancer has been made, the social worker in the cancer field has the added responsibility of making clear to the patient just what he must do about it. If cancer has not been diagnosed the social worker must convince the patient of the value of the medical opinion and persuade him of the need for treating any ills that are present. Since 75 per cent or more of those coming for cancer do not have it, a real contribution will thus be made to the whole problem of chronic disease, which is so much bigger than the cancer problem itself. In the case of patients with deferred diagnoses, the social worker must convince them of the importance of examinations in the immediate future so that they will not lose faith and thus delay treatment.

A large part of the social worker's responsibility must be to assemble and collect the failures due to inadequate community resources and to see to it that these persons come to the attention of those who

can provide treatment. To work out a practical plan for treatment is not enough, however. The plan must be followed through, and there must also be extramural follow-up. As long as 45 per cent of clinic patients show an interval of more than 6 months between their first visit to a doctor and the application of adequate therapy, this phase of follow-up will offer perhaps the greatest opportunity to the social worker in the whole field of cancer control. Though not a part of cancer control, it is the duty of the social worker to provide not only relief from suffering in terminal cases but also custodial and nursing care.

Discussion

FRANK RECTOR, M.D., New York: There is no disease in which the social problems connected with it demand a person adequately trained in medical social work more than in cancer. The social worker can be of aid in tracing responsible friends or relatives and acquainting them with the facts, in making financial arrangements, in persuading the patient and his family to see the matter through, and in following up the patient over succeeding years. The social worker, too, can easily keep in contact with the patient so that he will not fall into the habit of shopping around for medical attention and thus delay needed treatment. The insistence necessary at times to obtain accurate information regarding old patients may strain the ethical principles of the physician, but will have no such inhibiting influence on the social worker whose training will enable her to follow such cases through to a conclusion.

The function of the social worker as an educator cannot be too strongly emphasized. Her contact with the social background of the patients will enable her to ferret out cancer histories and suspicious symptoms that will be of great aid to the attending physician.

OUR RESPONSIBILITY AS TRUSTEES

F. L. BRAMAN, Torrington, Connecticut: Trusteeship is a distinction and a trust expressing honorable estimate of a person's standing in his community. It is expected that those who accept such positions will evidence the same interest in the hospital as in their private affairs. A composite board, one composed of professional and business men, should be better able than any other to cope with the many problems arising in hospitals. Members of the active medical staff, however, should not be eligible for appointment.

Trustees are not required to follow the routine of the everyday business of the hospital but instead should delegate such duties to the administrative staff. It is the responsibility of the trustees to know that those chosen to represent them in the management are honest, capable, and diligent in the interests of the hospital and the public which it serves. The superintendent should be selected for his executive ability, thorough understanding of hospital and medical procedure, and some knowledge of law, in addition to qualifications of character. Once he has been selected by the trustees, the latter must respect his judgment. The line of authority is always through the superintendent and never directly to his subordinates, as any other method is demoralizing.

The courts now obligate trustees to "exercise due and reasonable care" in the selection of the hospital's medical staff. The right to select the staff carries with it the right to reject any person who in the opinion of the trustees is undesirable.

Regular attendance of the trustees at meetings is essential, as this affords them the best opportunities to secure full information on the affairs of the hospital. It is the function of the board to insist that efficient business methods are used in the hospital, that all trust funds are safeguarded and properly administered, and that endowments are increased. One of the most important responsibilities of the trustees is co-operation with local health and welfare agencies thus to make of the hospital a community health center.

Discussion

WILLIAM C. GEER, Ithaca, New York: The three billion dollar capital investment of the more than 7,000 hospitals in this country indicates clearly that if these institutions are to be properly operated, the trustees must apply to their management those principles of organization which have made business elsewhere a success. The hospital has ceased to be a charity to which a gift of a few jars of jelly is able to satisfy the conscience of the giver or the needs of the institution.

In order to place hospital management on a business basis, trustees have a duty to obtain, by reading, attendance at meetings, or by actual efforts in directing their institutions, a concrete knowledge of the problems involved. In acquiring such knowledge or executing their responsibilities, however, trustees should never attempt to carry out any policy over the head of the superintendent or other active employees. No director of a corporation would think of going over the head of a general manager or superintendent and giving orders directly to a factory foreman. No more so should a trustee give his orders to any except the hospital's chief executive.

PROMOTING A BETTER UNDERSTANDING AMONG THE BOARD OF TRUSTEES, SUPERINTENDENT, AND MEDICAL STAFF

CHARLES F. NEERGAARD, New York: No one thing can contribute more to hospital progress and economy than to have a large proportion of the members of each board of trustees grasp the basic principles of hospital service and contribute more of their business experience to hospital management.

Four principles to be kept in mind in maintaining proper relationships of the board to the superintendent are: (1) the trustees should direct and the superintendent administer the hospital; (2) the trustees should define the fundamental policies and the superintendent see that they are enforced; (3) the

basic principles of good hospital management should be identical with good business management; (4) the trustees should be in a position to appraise the quality of the hospital's service and the efficiency of its administration.

Sound management requires that the superintendent meet with the board, yet this is often disregarded. The superintendent's position also demands a centralization of authority, yet trustees frequently criticize employees and give orders directly, a procedure which tends to be subversive of discipline. The trustees should give the superintendent the backing and advice constantly needed, as well as latitude in accordance with his capacity. There are numerous instances where men of high ability are given too little authority and men of small ability, too much.

In their work of establishing policies, the trustees should render decisions on the following: the broad medical classification of patients to be admitted, the basis of staff appointments, adherence to the standards of the American College of Surgeons and of the American Medical Association, the scope of the superintendent's duties, the budget, the financial policy in dealing with patients and in collecting accounts, publicity, vacations, compensation to sick employees, the curriculum of the school of nursing.

Many a trustee still looks on his hospital primarily as his pet charity, a thing somewhat apart from business. Rarely does the board have a competent analysis made of the underlying causes when a deficit exists.

Trustees today can find precedent on almost every subject that arises in connection with hospital management; hence the fact that they are not experienced in hospital procedures need not deter them from making a thorough appraisal of the institution which they serve. The following are the more important yardsticks by which trustees can measure hospital values:

1. Is the hospital suited to its community, and adequately equipped in all departments?
2. Is there a program to meet any fundamental deficiency in either finances or service?
3. Is the scheme of organization sound in principle?
4. Is the medical staff adequate and enthusiastic?
5. Is the hospital occupied to at least 80 per cent capacity annually, and, if not, what remedies are to be applied? Are there ample accommodations and special inducements for the middle class?
6. Is the physical plant in good condition?
7. Is the per capita cost reasonable?
8. Is the hospital conducted in a genuine spirit of service?
9. Is the business management sound and modern?
10. Is the superintendent a satisfactory business manager, a conscientious worker, and suited to his job?

In filling vacancies for the position of superintendent in large hospitals, it would be of advantage to consider the administrators who are doing good work for small and medium sized institutions. Hospitals could well call upon the state hospital associations for information concerning likely candidates.

Concerning the relation of the medical staff to the management, it is not advisable that members of the active staff be appointed to the board of trustees. Governing boards of private hospitals have the right to determine either reasonably or arbitrarily the qualifications of the physicians who may practice in the hospital. There should, however, be a committee of the senior members of the consulting staff, on whom the lay board can rely for unprejudiced guidance in matters of staff appointments and professional standards.

The medical staff should have regular and direct official contact with the trustees. The most logical and generally accepted procedure for effecting this is through the formation of a medical council consisting of the chiefs of the major professional services annually appointed by the board, one or more trustees, and the superintendent. Such a council is advisory to both medical and lay boards. It has the advantages of providing no opportunity for one man control, no excuse for overlooking important needs, no basis for misunderstandings.

The increase in number of active local hospital councils in metropolitan areas is most commendable from the standpoint of bettering relations among the trustees, superintendent, and medical staff.

Discussion

JOHN R. HOWARD, JR., New York: The most vital recommendation made by the previous speaker was that the trustee should know his superintendent as a man and as an executive. Probably the more important and the less common is to know him as a man. A hospital director is supremely conscious that he is a hired employee dependent upon his job. One needs but to glance at the statistical reports showing the rapid turnover in hospital executives to know how insecure this dependence is, and it is this very condition that lies at the bottom of much ineffectiveness of hospital executives.

To offset it, the trustee should encourage the superintendent's frank opinions of affairs in the hospital, the medical staff, or even the board of trustees itself and should weigh his ideas as those of a person close to the needs of the hospital. On this basis the trustee would bring to the administrator reports of untoward conditions, not as an employer to a "chief clerk" but as a partner in a difficult and complicated human service. Superintendents with such backing would report deficiencies in operation and their own inability to correct them and would welcome the employment of outside advice when indicated. Among hospital executives an expert is defined as a man from somewhere else. It is general experience that trustees are more apt to adopt measures proposed by outsiders than by their own executives, although hospital consultants say that many of their ideas come from the local superintendent.

In a frank, friendly atmosphere the trustees will get the benefit of the administrator's knowledge.

Concerning the relation of the superintendent to the medical staff, most of the trouble would be obviated if all involved realized that the director is acting as the agent of the trustees in administrative matters and as the agent of the medical board in such matters as are under their jurisdiction.

No systematic method has yet been established for training hospital executives and none for trustees to find those who have proved their ability. Until these two things have been done conditions will remain unsatisfactory. Meantime the insecurity under which superintendents work is one of the chief factors in keeping good men out of the profession.

BY WHAT CRITERIA CAN THE GOVERNING BODY JUDGE THE EFFICIENCY OF THEIR INSTITUTION

S. S. Goldwater, M.D., New York: The use of comparative statistics as a method of gauging hospital efficiency and the satisfied customer test are not always reliable. Statistics on such subjects as cost per bed, the hospital's deficit, ratio of personnel to patients, percentage of recoveries, and average stay can be used as accurate indices of the hospital's condition only if various relative influences are taken into consideration. To understand the meaning of the term, "cost per bed," it is necessary, for instance, to consider the ratio of private rooms to ward beds, the range of the hospital's laboratories, the extent of auxiliary services, and whether or not bassinets are included in the census. At first glance the hospital whose per capita per diem figure is highest seems to be the most extravagant, when as a matter of fact this institution may be performing a highly commendable service at a relatively low cost.

The opinion of patients is no better guide as to the hospital's efficiency than are comparative statistics, for although widespread dissatisfaction among the patients is a certain indication that the institution is not functioning properly, many things may be wrong with a hospital about which the patients know little and care less.

Another method of measuring a hospital's standing is that of observing the degree to which it conforms to basic principles of hospital administration. In this, national organizations can be most useful, and the field has been most conspicuously cultivated by the American College of Surgeons, whose definition of minimum standards has been the means of converting many a hospital to better ways. The basic requirements such as an organized, competent medical staff, clinical records, and analysis of end-results, are of fundamental importance, but satisfactory administrative standards cannot be achieved without dealing with additional questions which arise in respect to the internal administration of the hospital and its relation to the community. Accepting as of prime importance the minimum standards, there are a number of other criteria worthy of inclusion in a more comprehensive standardization program. Among these are the questions of whether or not the hospital corresponds to community needs as revealed by an authoritative survey, co-operates with other hospitals in an interchange of records, safeguards the admitting department against undue influence, protects the health of its workers, rigidly controls the stock of the pharmacy, provides for meeting needs that are not budgeted, and whether or not the labor turnover is excessive.

It is a common mistake to regard hospital standardization as a state or condition of being, rather than what it is, a process of growth, involving constantly renewed efforts to eliminate what is inconsistent with the highest ideals of service to the sick.

THE APPLICATION OF BUSINESS PRINCIPLES IN HOSPITAL ADMINISTRATION

Howard S. Cullman, New York: Many a hospital's business problems would be solved if the nature, functions, and qualifications of board members could be permanently defined. Trustees' responsibilities are twofold: (1) to provide ample funds and (2) to lend aid, supervision, and interest to all the lay aspects of hospital work. The trustee is called upon to make one essential renunciation—to leave to professional men and specialists all matters that may be classed as definitely professional and scientific problems.

The application of business principles to the hospital is complicated by the fact that the hospital, whether municipal or private, is not a commercial enterprise. It is an humane institution not measurable by the popular demands of business, an institution often hampered by grotesque deficiencies in community planning such as could never exist in the world of commerce. The problem is one of striving for humane results that cannot be measured in dollars and cents but which depend, nevertheless, on dollars and cents for their fulfillment.

Eager as many trustees seem to have a hand in medical matters, just so reluctant have they appeared in investigating and directing the vast body of administrative and practical details which are their rightful province. The average board member feels that he is doing his bit if he helps raise money for and contributes to actual maintenance charges or expansion programs. His efficient performance of even this task is hampered by the delusion, popular among trustees, that a healthy deficit is in some way praiseworthy and a sizeable surplus, disreputable. Obviously neither a surplus nor a deficit is a check on hospital success. Efficiency can be judged only by a comprehensive grasp of the individual hospital's problems. It is just such a grasp that the superficial interest of the average trustee renders impossible. The average trustee has little or no analytical conception of his hospital's budget.

The result has been that the trustee is fond of judging his superintendent's efficiency by such convenient indices as per capita cost. Yet it must be apparent that such statistics, unanalyzed, are frequently misleading.

Such instances of mismanagement as the lack of uniformity in wage scales in a given community, failure to control procedures, uneconomic buying methods, and the great variation in accounting systems could never exist were hospital directors not trustees in name only. Nor would any trustee who had taken the trouble to analyze his hospital's budget tolerate such an abuse of philanthropy as is now being practiced in workmen's compensation cases. Hospitals should be fully reimbursed by insurance companies for the cost of these cases, and the public should not be burdened with the difference between actual cost and inadequate payments. Yet there are some hospitals which, apparently with the support of their trustees, are competing at cut rates for compensation cases.

Group planning and co-operative action are needed to solve hospital difficulties. A unification of the entire hospital system would, under ideal circumstances, be a long step in straightening out the economic hodge-podge of the situation. A present obstacle to co-operation might appear to be the division of hospitals into municipal and private institutions, yet the term "private hospital" may be a misnomer for such an institution is supported by the public and there is nothing private about its function. From a business point of view the justification of the private hospital might be open to question, but in lieu of a disinterested, efficient state operated system of hospitals, the need for private institutions still exists. But we need wait for no millenium to apply business principles to the hospitals.

Discussion

JOSEPH J. BAKER, New York: Exception was taken to Mr. Cullman's statement that many a hospital's business problems would be solved if the nature, functions, and qualifications of board members could be permanently defined. Many persons come within the scope of the definition in their business affairs but when such individuals are named as trustees they become dual personalities. They work in business but merely grace the hospital board with their presence.

Most hospital boards need both workers and givers. The presence of the trustee who can give liberally helps solve a large problem in many hospitals. Trustees should not so far renounce all professional and scientific problems as to exclude such matters as the selection of the medical staff and the internes, the investigation of long-stay cases, the addition of new departments or clinics.

A deficit does not necessarily prove simply the inadequacy of the board as money raisers. It shows that business principles are not applied in the administration of hospital affairs. The capital of the hospital, its plant and endowment, are gifts in trust to be prudently managed by the board to the end that all income therefrom be devoted to the public good but also that no part of the principal shall be used up in current operation. The amount of free service rendered must therefore not be overdone. A hospital that is consistently running behind in operation cannot justify the continuance of free service on the same scale as previously. Trustees violate their duty if they use up the hospital's capital to meet deficits. Every hospital needs to balance its budget and live within its means. With a budget as a guide trustees should apply business principles and win from the public increasing confidence.

WHAT DO HOSPITAL TRUSTEES EXPECT FROM THEIR SUPERINTENDENT

J. ALLEN JACKSON, M.D., Danville, Pennsylvania: The task of selecting a qualified superintendent is made difficult by the fact that there are no training schools especially designed for this work and that there is no roster of qualified individuals available. The limited facilities for training superintendents are due to the trustees of the past who failed to recognize the importance of higher education and continued to offer such small salaries that men and women would not spend time and money to fit themselves for a superintendent's position.

Provided that the trustees pay an adequate salary, assure a reasonably long term of office, and understand that the superintendent is to be given full authority, they have a right to expect that he will have the proper personality, a certain amount of experience and training, and will achieve definite results in his work.

By the term, "personality," it is not meant simply that the superintendent will be able to "sell" the hospital to the public but rather that he will be an individual of good mental and physical health, emotionally self controlled, and possessed of a high intelligence rating.

It is an expensive process for the trustees themselves to train a superintendent for his work. Instead, they should select a person who has had a background of administrative work, such as hotel management. Another plan, for the smaller hospital, would be to choose a person who has served as an apprentice in an administrative department of a 200 bed hospital. The larger hospitals will do well to choose capable superintendents from the smaller institutions or to make promotions in their own organizations.

The best way to determine the abilities of any executive is to see him in action, but this does not imply that the superintendent shall be always in the wards, in the power house, or in the kitchen. However, he should have definite hours, best known to himself, set aside for inspecting each department, and appointment hours for visitors. He is expected to be the official representative of the hospital and to conduct himself accordingly.

The trustees have the right to expect that the superintendent will govern the hospital so that it will have the approval of agencies supporting it, the medical and nursing professions, the allied agencies, and the general public. Within the hospital the trustees expect order and that all trivial details will be handled by the administrator himself.

Discussion

THOMAS S. MCLANE, New York: Progress is hindered if there is a question of trustees versus superintendent; the situation should always be trustees in co-operation with superintendent. No trustee or superintendent can meet the exacting duties incident to his office unless there exists a feeling of harmony among the members of the medical staff, the governing body, the director and assistants of the school of nursing, and the administrator. This can best be assured through meetings where first hand, direct information may be obtained and petty differences adjusted. At Roosevelt Hospital, New York, the Committee on Co-operation, composed of two trustees, two members of the medical board, the superintendent, and the director of the school of nursing, meet each month between regular meetings of the medical board and the governing body. Thus the trustees are relieved of unnecessary detail and only the larger and more important matters of hospital administration are brought to them.

A COMPLETE SYSTEM OF DAILY REPORTS ESSENTIAL IN EFFICIENT HOSPITAL ADMINISTRATION

SIDNEY G. DAVIDSON, Grand Rapids, Michigan: The purpose of reports which the superintendent receives regarding the administration of the various hospital departments is twofold: to furnish the board of trustees and the community full information regarding hospital operation, and to furnish data for studies designed to improve hospital administration.

An outstanding example of this idea is to be found in the city of Cleveland where the hospital council last year published a handbook covering such features as the keeping of vital statistics, of operative procedures, accounting, etc. The handbook recommends reports from the following departments or services: admitting office, nursing office, record room, laundry, laboratory, operating room, delivery room, and dietary, X-ray, special therapy, outpatient, and medical social service departments. The speaker suggested, in addition, a report from the engineer, the housekeeper, the commissary department, and a report of the cost of meals served. The superintendent should also have a daily report of earnings, expenses, and amount of cash collected.

Hospital management should be business management. Though the social, psychological, and scientific factors enter into hospital management they are to be found also in the commercial organization. The hospital administrator should have the same qualifications as the chief executive of any other big business, and these should consist of high grade administrative ability, a mind capable of developing the business, and sufficient vision to develop it along proper lines. It follows that reports which the hospital administrator receives should be comparable to those of large manufacturing plants or other businesses. A report of the hospital's expenses, which includes both labor and supplies, and a report of the earnings of the various departments should be made each day. Of equal importance is the report of the number of patients in the hospital and the amount each is paying.

Detailed reports are not necessary from each department, with the exception of the laundry where, because of the large number of persons handling the linen, a report should be made daily of the articles washed so as to check this figure with the number of patients in the hospital. As it is necessary that the administrator report to the trustees at their monthly meeting, the department heads should give him a statistical report at the end of the month.

A daily report far more necessary than any of the above is the "report of unusual instances," in which are set forth any errors or mishaps that have occurred and also any act of outstanding service on the part of employees. In the matter of unusual instances no department head should be given the sole right of authority to settle the difficulties with the affected person, except as so instructed by the superintendent.

Discussion

HOWARD E. BISHOP, Sayre, Pennsylvania: Departmental reports are valuable only so far as they are made use of to improve service, reduce costs, eliminate waste, increase receipts, or serve as a spur to better efforts. The list of reports recommended by Mr. Davidson the speaker thought excessive but agreed with the principle of having standardized reports.

There are a certain number of daily reports which are quite necessary but which it should not be the duty of the superintendent to review. He should have a condensed report of the number of patients, their distribution according to departments and type of accommodations. A daily report of the number of nurses on duty, both graduate and student, with notation of absences and reasons therefor is also valuable to him, but a more elaborate report showing the hours on duty is unnecessary.

Certain departmental reports, such as that on the number of meals served and their cost, should be filed with the business office to become part of the monthly report. Even a daily report of receipts and expenditures in the dietary department is not essential as monthly records are better for a fair comparison.

The monthly report to the trustees should not be made in too much detail. The number of patients treated, results of treatment, and a comparison of these with figures for the previous year, together with a comparison of receipts and expenditures are the kinds of information desired.

A monthly report from the engineer and the housekeeper, and a quarterly report from the storekeeper will prove helpful, also a report from the directress of nurses following her monthly conference with her staff.

Hospitals could profitably forego a number of reports now provided and include some of a different sort such as the list of critically ill patients and the

news report on accident cases or prominent patients, prepared so as to prevent errors getting into print.

HOW CAN SCIENTIFIC CLINICAL RECORDS BE ASSURED

JAMES T. NIX, M.D., New Orleans: Clinical records represent the story of the patient, undeleted and supplemented by thorough, searching investigation as to progress and treatment. They should be an account of facts, entered in writing for preservation.

The elements entering into a record should be diagnostic, therapeutic, and prognostic. Use should be made of some standard nomenclature and such approved forms as are applicable to the particular hospital in question. A modification of the record form devised by Miss Jessie Morris, record librarian of the Butterworth Hospital, Grand Rapids, Michigan, was illustrated in slides.

Records should be modified to meet local conditions, but a definite, detailed system should be carried out in every institution. Records should be thorough and accurate and have appended to them reports of the various laboratories. Photographs should be used in all departments as an accurate and lasting means of recording observation.

Failure to have a good record system falls into one or more of three divisions:

1. Executive—this is registered in the physical or manual equipment but is seldom at fault.

2. Nursing—incorrect or incomplete bedside notes are frequently found.

3. Medical—the data compiled by this division are by far the most important, yet frequently inadequate.

4. Follow-up—this is essentially the work of outpatient clinics, social service departments, or visiting physicians; even a poor follow-up is absent in most hospitals.

The efficiency of a hospital might well be judged from its case records, for it is no better than the poorest histories that the authorities permit to be filed. In the last analysis, the duty of maintaining satisfactory records falls on the medical staff. Whether the routine of examination, history taking, and recording of facts is delegated to the graduate interne or to the clinical clerk, the final responsibility is rightly placed on the medical staff.

Following are suggestions for improving the record system: (1) the record room should be centrally located; (2) frequent contacts should be established between record room officials and the medical staff by means of regular meetings; (3) a report from the record department should be included at each clinical conference; (4) names of persons delinquent in completing records should be posted in the record room, library, or staff room; (5) a certified librarian should be employed; (6) standard nomenclature is needed; (7) the histories of all patients requiring surgery should be read in the operating room prior to operation; (8) triplicate reports should be made of the operating room notes and laboratory reports; (9) the surgeon should not operate until all necessary records are completed and attached to the chart; (10) standard history forms such as those recommended by the American College of Surgeons should be used in private offices as well as in the hospital.

An adequate number of residents usually assures complete histories. If a premium on interneship and staff membership is established, good records will result.

The address was concluded with lantern slides showing the record departments in the hospitals of New Orleans.

A CHECK SYSTEM FOR CURRENT CLINICAL RECORDS

DOROTHY GILMAN, Seattle: This check system for records, in use at Harborview Hospital, would not conflict with any other form of record keeping already installed. Under this plan, as soon as a new patient is admitted, a check-up card is made out in the record office, which contains such data as the identification of the patient, date of admission, interne, service, and provisional diagnosis. The card is filed and a small transparent red signal is attached to indicate a new patient. While the patient is undergoing the various stages of hospital care such as examination, operation, and medical treatment, his clinical record is checked so as to keep it up to date, particularly for the physical examination, personal and family history, routine laboratory procedure, last date of physician's orders, date of last progress notes, graphic chart, consultations, operative and anæsthesia record. If any deficiencies are noted the red signal on the check-up card is replaced by a green one. The interne is then notified of deficiencies on records of which he is in charge. When he has made the necessary additions and notified the record office of them, the green signal is removed from the card, indicating that the clinical record is checked and is satisfactory in every detail.

Whenever a patient is moved from one ward or wing to another, the record office is informed of his old location and the place to which he has been moved. In this way a positive check is maintained on all patients. Transfer slips are handled in the same manner. At time of transfer a form is filled out and sent to the record office and this notation is made on the check-up card.

When the patient is discharged, the check-up card is removed from the filing cabinet and completed by the record clerk so as to indicate the date, condition on discharge, and final diagnosis. The card is then filed with the chart. Should the patient be readmitted, the same card can be used. Receipts are required of all persons taking a chart from the record room, and in addition the check-up card is kept in the current file until after the chart has been returned.

The check-up card was found to be the only method which assisted the hospital described in having charts completed before patients were discharged.

GROUP STUDY AND END-RESULTS

IRVIN ABELL, M.D., Louisville, Kentucky: Many hospitals which at first thought the minimum standard of the American College of Surgeons too exacting are today setting their standards on a still higher plane with a realization of the benefits that accrue.

The adoption of the minimum standard has resulted in increased use of laboratory facilities with consequent advancement in scientific treatment, in the keeping of clinical records which when well done afford rich material for research, in staff conferences which enhance proper correlation of methods, in reduced mortalities and morbidities, in better nursing care, and in more effective hospital administration.

Fellows of the American College of Surgeons have a responsibility to the hospital standardization movement that implies active participation in all of its phases. One of the most important of these duties lies in connection with the selection of new staff members and the extension of privileges. The staff should have the prerogative of passing judgment upon applicants, but in so doing members should be governed by an impartial estimate of the professional qualifications and personal integrity of the candidates. The staff of an approved hospital cannot escape its responsibility for the character of the work done therein and the practices in which its members engage. But in order to be familiar with the clinical results it is necessary for the physicians to attend staff conferences at which analyses of various departmental activities are presented for discussion.

To have the proper material at hand for clinical conferences involves the keeping of accurate records and their intelligent tabulation. An analysis of the hospital's records for the year on a given disease, organ, or system, such as appendicitis, pneumonia, fractures, offers abundant matter from which valuable deductions regarding diagnosis and treatment can be made. If the staff members of each approved hospital would undertake the systematic analysis and study of their work year by year, records would become more accurate, staff members would increase their knowledge and improve their judgment and thus raise the standard of clinical results. The compilation and classification of the aggregate studies from all approved hospitals would yield an enormous amount of data for clinical research. The American College of Surgeons already has a number of outstanding committees whose task it is to search the experience in all parts of the country as to the treatment of particular diseases in which there is no certainty of a treatment of choice.

If statistics from approved hospitals are to furnish adequate data upon which to base scientific deductions it is essential that a follow-up be made of patients with certain types of pathological conditions, such as cancer, hernia, and peptic ulcer. This follow-up can be readily accomplished by a committee of two or three staff members working in collaboration with the historian and the record department. Follow-up contact permits instruction as to continuation of treatment and is a means of preventing relapse. It has a positive value in determining the worth of a given procedure in treatment, and through this information as to the efficacy of the various methods, hospital records become more comprehensive and of greater value for research.

A PLAN FOR MEASURING SURGICAL RESULTS IN THE COMMUNITY HOSPITAL

CARL E. BLACK, M.D., Jacksonville, Illinois: The speaker described a plan in use at Passavant Memorial Hospital, Jacksonville, by which a 9 year survey of all the cases involving appendicitis was made. Before explaining the plan he emphasized the need for uniform methods of determining surgical results. While standardization should never be carried to the point of limiting individual initiative it should enable each surgeon and each hospital to discover how their work compares with that of other surgeons and other hospitals. There is not only need for standardization of methods in collecting and tabulating facts but also in methods of calculation.

Recent studies have shown an increased death rate from appendicitis and a number of other diseases treated by surgery, and it is hoped that the standardizing agencies will be stimulated to devise a plan which will discover why there is an increase. Uniform methods of measuring surgical results should be of aid in this.

The necessary data which will determine the real results of surgery should include the following: number of cases, deaths, days in the hospital, days of illness prior to operation, days in the hospital prior to operation, character of the cases, postoperative infection, condition of the patient 3, 6, and 12 months after operation, and postoperative complications.

Averages of mortality rates for the 1,605 cases studied at Passavant Memorial Hospital showed wide variation; the combined average was 4.88 per cent. If the work of one surgeon were excluded the mortality rate for the cases analyzed drops nearly one point, an indication that studies of this nature if developed in more hospitals might well reveal where inferior work is being done. The study showed at least two periods in which more than 1,000 operations were performed without a death, a fact that points to the need of tabulating thousands of cases. The analysis revealed that among these cases of appendicitis there were 150 other diseases (nonsurgical); 441 other major operations, 46 minor operations, 96 cases with two other major operations, and 31 cases with 3 other major operations.

The system for checking results requires the use of separate sheets, one for each surgeon, for each disease of every organ operated upon. Thus, for instance, there would be a separate sheet for the appendix with chronic infection and another for acute appendicitis. Each time a record is completed, this sheet must be checked by the record librarian. Previous to this, however, a summary card is made out

containing such information as the diagnosis, the pathology, type of operation, days of illness prior to entering the hospital and prior to operation, complications, and condition on discharge. If there is an additional operation, another summary card must be filled out. The surgeons' annual sheets, described, are then checked from the summary cards. At the end of the year all the cases of any particular class for each surgeon are found on his sheet and it is only necessary to add the columns to know what results he has obtained. The names of the operators are indicated only by symbols. The standardizing agency would not be interested in knowing the names except in the case of hospitals showing results glaringly out of line with good work.

A start toward standardization of surgical results could be made voluntarily by a group of hospitals. The publication of these analyses would stimulate other institutions to be included in the list, until finally those hospitals that did not want to be included would be under suspicion and, if on the approved list of hospitals, could be investigated.

Discussion

T. R. Ponton, M.D., Augusta, Georgia: A system worked out by him in collaboration with Dr. C. E. Phillips, of Los Angeles, for keeping record of surgical results of operators in approved hospitals was referred to. The plan which provided for a national central office was presented at a previous Clinical Congress but was not accepted because of the prohibitive cost.

The speaker said that following this he began work on a system whereby the individual hospital could keep a record of the work of surgeons working in its wards, so as to have a guide in making appointments. The plan was founded on the premise that a mere record of death does not give a just estimate of competence and that since so few true end-results are known records must for the present be based upon the immediate mortality rate.

All operations were therefore grouped as elective, emergency, or palliative, and the risk stated as good, fair, or bad under each one of these groupings. Before commencing operation the physician would indicate in which one of these nine classifications his patient came, and if he considered the risk as fair or bad would be asked to state his reasons. If the patient left the hospital alive, the result would be recorded as "recovered." In the group of elective good risks, practically all entries should read "recovered." By summarizing these records a fairly accurate index is obtained of the surgeon's competence.

The success of any system depends on the cooperation of the staff. The first requisite for securing such support is that records be kept private. One advantage of the last mentioned system is that it indexes results in such a manner that the proportion of successes and failures is at once apparent and the patients' records are always readily available for study.

PUBLIC RELATIONS

Homer Wickenden, New York: Hospitals are public utilities and they may well follow the lead of other public utilities in developing their relationships to the community. Their purpose in doing so would be to create confidence on the part of the public, to make friends who will give financial support, and to educate the public in prevention of disease.

The best work that hospitals can do in the field of public relations is the cultivation of personal contacts. If a hospital has limited resources to devote to publicity, its energies are far better spent in making a friend out of every patient than in cultivating the public in general. It will be worth while for the superintendent to analyze all the points where the public comes in contact with the personnel and the service of his institution and at each point to see that the contact is made in the most courteous and helpful way. A courteous admission clerk, a telephone operator with a pleasing voice, a cashier who tactfully interprets the hospital's financial policy, exemplify the desirable relationship. Unless the superintendent himself evidences concern over the welfare of each patient, the employees are not likely to make any efforts in this direction.

For intensive publicity, there is nothing comparable to the personal cultivation of the patients and friends of the institution, but for extensive publicity, there is no medium like the newspapers. The latter offer such channels as news stories, editorials, feature stories, human interest stories, letters to the editor, pictures, and paid advertising. The superintendent can do much to aid the reporter in finding sources of news in the hospital but should not expect to write the story. The preparation and interpretation of hospital news is a job for an expert, and hence it is desirable that the institution have the services of a trained publicity director.

Annual reports, another form of publicity, have a limited usefulness as ordinarily they reach only persons already interested in the hospital, and also because they do not challenge interest. It is possible, however, for a publicity director to present the material contained in them so as to have a stronger emotional appeal. Most hospital reports and pamphlets can profit by better pictures, better typography, better paper, and also by a better literary style in the text.

Radio also offers opportunities for hospital publicity, but here again the material must be prepared by an expert, with the special requirements of the radio in mind.

All the goodwill created by publicity will be of little value in gaining financial support unless the campaign for funds is organized. There should be some person in charge—superintendent, trustee, or employee—who knows when to seek funds by personal solicitation, when by letter, how to make up a list of prospects, to organize committees, to stage meetings, in brief, who knows how to stir the community to enthusiasm.

ORGANIZATION AND MANAGEMENT OF THE CENTRAL SUPPLY ROOM

HELEN MEADE, R.N., Jamaica, Long Island: A central supply room as described by the speaker is a single unit for issuing all sterile supplies as well as most other equipment used in the care of patients. The degree of success of its operation is a matter of life or death to many patients, for the most elaborate operating room equipment and the most careful nursing technique can be set at naught by poor sterilization.

The central supply room, the facilities of which can be made to serve both the hospital proper and the outpatient department, should be centrally located, near one of the general elevators if it has no dumbwaiter of its own. Because of the high temperature of the sterilizers and since some persons will be confined to the rooms 8 to 10 hours a day, this unit should have more than the usual advantages of light and air.

Two rooms, one for sterile and the other for non-sterile supplies, are needed. These can be separated by a partition containing the sterilizers. A most rigid system should be adopted for transferring articles from the non-sterile to the sterile room. The former should be equipped with cupboards of varying size, bins as receptacles, hot and cold water, and a hot plate. The purchase of cheap sterilizers is false economy.

The director of the supply room should be a graduate nurse, especially trained for the work and familiar with all the details of the mechanical equipment. Only the director should actually operate the sterilizers. It is an excellent plan to have her rather than the engineer supervise all sterilizing apparatus in the hospital as she is more likely to appreciate the importance of strict asepsis. Student nurses should be assigned for a period to the central supply room so that they may understand the necessity of asepsis and the method of attainment.

Surgical supplies, gauze, operating room sets, soaps, solutions, and everything needing autoclave service, together with thermometers, syringes, oxygen apparatus, croup kettles, electric bakers, etc., can well be dispensed from the central supply room. Smaller utensils and instruments can best be prepared in the individual departments or on the floors. The central system provides for orderly issuance and return and offers an opportunity for regular checking of instruments, some of whose delicate mechanical operations involve the life of patients.

A system of requisitions is essential. In Mary Immaculate Hospital, Jamaica, there is a weekly requisition of hypodermic needles, tubing, and such other articles the needs of which can be determined over a longer period, and a daily requisition of general supplies and of special and more expensive dressings. From the latter list is determined the charge for extra dressings. At 4 p.m., requisitions are collected and unsterile trays are returned to the supply room. Supplies are distributed at 8 a.m.

Advantages of the central supply room are that it relieves the nurses of many time-consuming duties, assures sterilization under the supervision of a trained specialist, makes for economy through supervision of the requisitions, and provides an economical and satisfactory method of supplying special equipment.

MANAGEMENT OF THE OBSTETRICAL DEPARTMENT

MABEL DURYEA, R.N., Brooklyn: The maternity department of the Methodist Episcopal Hospital, Brooklyn, was described as a separate unit of six stories having a capacity for 100 beds, one-third in private rooms, one-third in semi-private rooms, and the remaining third in wards. Admitting rooms, administration offices, staff rooms, record rooms, and clinics are located on the first floor; patients' accommodations on the second, third, fourth, and fifth floors; and the delivery and operating rooms on the sixth floor. The building is administered as a separate unit, with its own admission office, accounting department, and record room. All patients are admitted and discharged directly through the admission office.

Students from the school of nursing are assigned to duty only on the ward floor and the clinics. The interne staff consists of one resident, one senior, and two junior internes. The resident has charge of all normal ward cases and may delegate the delivery of them to the internes. He may also delegate the delivery of abnormal cases to the senior interne under his direct supervision. The resident signs out all ward patients after ascertaining that their charts are complete.

A prenatal clinic is held daily each morning, with the exception of Tuesday when a follow-up clinic for infants is conducted. A dystocia and toxæmia clinic is held on Saturday morning, preceded by a "mothercraft" lecture. Postpartum clinics are held twice weekly.

When ward patients are admitted they are received by a nurse, are immediately examined by the resident or the senior interne, and, if accepted, are prepared for the antepartum room. If the patient becomes disturbing to others she is taken to one of the several labor rooms, whence she can be easily transferred to the delivery room. After delivery the patient is immediately returned to the ward, and the delivery room nurse remains with her. Identification of the infant is made by means of a necklace, footprints, and the mother's fingerprints. A red ticket on the bassinet calls the nurses' attention to the fact that it contains a newborn infant and must be carefully watched.

Ward patients are not allowed their own clothes while in the hospital. The clothes list, after being signed, is placed in the chart so as to eliminate search in case of future reference. On discharge, the clothes are brought to the patient in the admitting room. The necklace is not removed from the baby until both are taken to the office, where the graduate nurse in charge removes it and shows it to the mother, in

the presence of the nurse discharging the patient and the person accompanying her home.

Face masks are worn by nurses at all times when handling babies, and mothers are required to wear them whenever nursing and until the babies are taken from the room. Visitors are not allowed in the room during the nursing period and on the wards are not allowed on the floor during this period. Babies may be seen only through special windows. All bottle feedings must be given in the nursery by the nurse. Babies are given a tepid alcohol sponge twice daily and are kept scantily clothed. The temperature of the nursery is observed closely to avoid overheating. When skin rashes become disturbing, the baby and the mother are removed to the isolation unit, and if pustules develop, mother and child are placed in a room together in this unit. Observance of these rules has reduced all types of rash in this department to practically nil.

It is a policy of the hospital to encourage partial payments at each visit. If any interruption of plans occurs, all money is refunded except the initial payment of five dollars and in case interruption occurs between registration and the time for the first clinic visit, this, too, is refunded. Since January 1, 1931, some 904 ward mothers have been admitted and of these, 463 bills were paid entirely before admission.

ORGANIZATION AND MANAGEMENT OF INTERNE SERVICE

CLAMOR H. MAGNE, M.D., Brooklyn: The first step in securing internes is to send announcements to the Class A medical colleges, with a description of the service offered. Once the service becomes known, further announcement is unnecessary. Last year over 300 applications were received at the Kings County Hospital, Brooklyn, although no bulletins had been sent out since 1918.

Candidates are asked to submit a photograph, a copy of their college ratings, and two or more letters of recommendation from persons who are acquainted personally and professionally with them. The dean of the medical school is also asked for an opinion concerning the applicant's ability and personality, as are the hospital's internes who are graduates of the same school as the applicant.

The examining committee then divides the candidates into three groups: Group A, those who are in the first third of their class, who have recommendations from well known persons, who have additional degrees, who are unmarried, and who are personally recommended by the dean and the house staff; Group B, those who have good ratings but are without additional degrees, or who are married; Group C, all who do not come under any of the above groups. Only the first two groups are considered for appointments. However, all candidates who are within 100 miles of the hospital at the time the appointing committee meets are requested to appear for personal interview, which may be a factor in changing their classification. Appointments are made by lot from Group A and alternate appointments by lot from Group B. The policy of requiring that applicants furnish certificates of good health from their colleges might also be advisable.

General rules governing the interne in the hospital provide that he shall attend staff conferences and accompany the visiting physician when the latter visits the hospital, and that he shall not involve himself in the legal or business affairs of the patient.

The interne is assigned to service by the medical board. Service is in the following order: pathological laboratory, general medicine, medical specialties, surgical specialties, ambulance and dispensary duty, obstetrics, general surgery. The ideal assignment of hours would be three daily 8 hour shifts, with the requirement that the interne be responsible for all work to be done during his time on duty and that he follow up all acutely ill or recent postoperative patients during his hours off duty. At present it is required that all internes be on duty from 9 a.m. to 5 p.m. Internes are paired on all services. One of each pair may leave after 5 p.m. without special permission but must sign out, designating his substitute.

Instruction is purely the function of the medical board. Should the full attending physician be unable or unwilling to give the time necessary to instructing the interne, he appoints one of his assistants. An assistant should also be appointed to review daily the interne's charts. Internes have arranged for monthly meetings at which a member of the visiting staff presents a scientific paper, followed by general discussion. Each month the attending physician rates the interne on observation of rules, conscientiousness, faithfulness, attitude toward patients and attending staff, promptness, history taking and record keeping, co-operation, clinical work, general progress. On the basis of these ratings it has often been possible to correct minor deficiencies early in an interne's career.

No hospital whose visiting staff will adequately instruct its internes need pay them, even when there is only a small amount of clinical material available. Adequate recreation should, however, be provided for the internes.

PROCEDURE IN ADMITTING AND DISCHARGING PATIENTS

MARY E. PILLSBURY, Brooklyn: The usefulness of any hospital depends upon how the community views it, and this depends upon the opinion of the discharged patients. Hence hospital administrators should bear in mind to what conditions patients are being admitted and in what condition they are discharging them.

Conditions that should be found on admission are a greeting; readiness of personnel and bed space; information as contained in a booklet explaining the cost of hospitalization, rules as to visiting, securing of special nurses, telephone communications with patients, and valuables and clothes; dispatch in admission activities, such as getting the house physician and preparing the patient for bed; assistance in orientation, such as instruction in calling the nurse,

self-introduction of nurses and internes. If these conditions are met, the administrator will find that complaints are fewer.

Admitting clerks, however, often have little appreciation for the importance of approach and of tact, and as a result internes and nurses are frequently handicapped by the impression given the patient in the admitting department. The remedy lies in classes for the admission personnel, better selection of workers, higher salaries, and better hours.

In discharging patients, it creates a favorable impression if they know of the date and the hour of discharge, if relatives are notified, if there is promptness in supplying clothes and arranging for settlement of the bill, if written advice is supplied and information is given of follow-up contemplated.

Emphasis throughout should be laid not upon routine methods involved but rather upon the spirit with which methods are carried out.

ORGANIZATION AND MANAGEMENT OF THE OUTPATIENT DEPARTMENT

MARGARET CLEARY, Brooklyn: From experience in the outpatient department of St. Mary's Hospital, Brooklyn, it would seem that the physical facilities are less essential to the success of an outpatient service than are the right type of personnel and good organization.

The outpatient department should not be a testing ground for physicians to make their way into hospital appointments, but instead assistants should be those who have shown from previous experience that they deserve the opportunity afforded in clinics. The director should be one of the best available and should have not only administrative ability but a capacity to teach his assistants. The clinics should never be manned by internes, for the reason that proper instruction is not possible if a staff member is not present.

In the hospital described, the chief of each service appoints a physician as chief of his clinic service. This may be the same as the chief of hospital service. It is essential that there be but one medical staff organization for the entire institution.

The outpatient department offers a unique educational source for the training of the student nurse. Too often a training school sends nurses to the outpatient department simply to substitute when other help is not available, instead of assigning them for a sufficiently long period so that they may acquire the nucleus of office practice and public health training.

The admitting officer for the clinic should be chosen with as much care as the one for the hospital. It is especially important that clinic patients be not regarded as of a different standard from that of hospital patients. In admitting patients, they should be sent first to the general clinics where the staff members in charge may refer them to the specialty clinics.

All clinic patients should be asked to pay a moderate fee, but the determination of the fee requires the experience of a trained social worker. If it is thought that clinic service is being abused and that physicians are losing private patients who could afford to pay for services, the social worker should investigate.

Records should be in charge of a registrar, not the admitting officer. It is more desirable that a special chart form be used for each clinic rather than to have one form attempt to cover all services. Clinic records should be kept in the same record room as those of the main hospital. Supervision of the contents of the records is the work of the record room committee and particularly the chief of clinic. Since the clinic is a hospital for ambulatory patients, there should be conferences for the analysis of the scientific activities just as there are in the hospital proper.

A policy of false economy ought not be allowed to undermine the outpatient department. Funds should be expended so as to provide particularly for an efficient staff.

ORGANIZATION AND MANAGEMENT OF THE DIETARY DEPARTMENT

ELOISE MCCREERY, Brooklyn: The organization of the dietary department at St. John's Hospital, Brooklyn, was described. The head dietitian has direct authority over the two assistant dietitians, the chef, the minor personnel of the department, and the receiving clerk. One assistant dietitian has charge of the food service and cleaning in the nurses' cafeteria, the dining rooms, and the private tray rooms and is also responsible for the linen and for issuing the daily food supplies. The other assistant has charge of the food service and cleaning in the ward tray room and teaches classes in dietetics for nurses.

The chef, the pastry cook, and the night cook have certain allotted duties such as their titles imply and must also be responsible for the work of their assistants. The receiving clerk is charged with receiving, storing, and issuing all supplies that come into the hospital and must keep record of these transactions.

Two week vacations are given to all employees in service for 1 year, and one week vacations to those in service 6 months. It is felt that vacations are a factor in decreasing labor turnover. Employees are given one day off duty each week.

The institution uses central tray service throughout. A house menu is used for ward patients for full, light, soft, and fluid diets. Semi-private patients receive a different tray service but the same type of food. Special likes and dislikes may be stated on the diet sheets, however, and are indicated on the name tickets. In so far as possible the general diets are used as a basis for trays from the special diet kitchen. Specially prepared foods are made by the three student nurses in training in the diet kitchen. Each nurse is required to write a case record of a special diet patient as part of her training. Special diet patients are interviewed by the dietitian and a student dietitian to ascertain their wants. Private patients are given a choice of foods, usually of cereals, eggs, soups, meats, salads, and often of vegetables and desserts. Special orders may be filled but it has been found that the selective menus have cut the special orders to a minimum.

Advantages of the central tray service are found to be that there is direct supervision of food service on the part of the dietitian, is served uniformly and appetizingly, and wastage is greatly reduced. The disadvantage is the delay in service that results unless the co-operation of the nurses on the floor is obtained.

So that the dietitian may keep in touch with the market and make her menus accordingly so as to avoid expensive foods, she should have the privilege of buying. Large quantity buying is wasteful unless storage facilities are at hand. Supplies from storage refrigerators should be issued by requisition, and a perpetual inventory kept of staples. Records of purchases of perishable goods are kept in the dietitian's office, and at the end of the month these are added to the sum total of the daily requisitions for staples, which have been computed daily by the receiving clerk. Thus the total expenditures for food used per month are figured. A record is also kept of the patients' and employees' meals served, and from these two types of records the daily cost per capita is reckoned.

OPERATING ROOM MANAGEMENT AND PROCEDURE

CATHAN MEGLONE, R.N., Brooklyn: In outlining the operating room management and procedure at Long Island College Hospital, Brooklyn, the speaker stated that a committee, composed of the heads of the various surgical departments, and the operating room supervisor are responsible for all operating room routine.

For booking of operations, a ledger is kept in the office of the operating room. Exclusive of emergencies all operations are posted before 6 P.M. of the day previous to operation. In case of emergency operations, 30 minutes or longer are allowed for setting up the operating room. The operating schedule is planned by the resident of each service and is arranged so that infected cases will not precede clean ones. After the schedule is completed a copy is posted in the ledger and another in the main staff room. Noted on the schedule are time of operation, patient's name and location in the hospital, type of anæsthesia, type of operation, surgeon's name, and a note of any special instruments or deviation from routine.

Nurses, during the second year of their training, are given a 6 hour course of instruction in operating room procedures and technique. Operating service is for 8 weeks and is divided into three equal periods: junior, second senior, and senior services. If the first two services are creditably performed the nurse has the senior privilege of taking cases under supervision of a graduate nurse.

The anæsthesia department is a specialized service in the surgical division and is under the supervision of the chief anæsthetist and assistants. Surgical dressings are made up from gauze purchased in 100 yard rolls. They are sterilized by being loosely wrapped in double muslin covers and subjected to 18 to 20 pounds pressure for 50 minutes in an autoclave. Medicated dressings are prepared using sterile technique and kept in air-tight containers. Opaque containers are required for iodoform dressings.

The daily record of patients operated upon is posted in the hospital auditor's charge book showing the patient's name, age, room, classification, type of operation and of anæsthesia, names of the surgeon, assistants, and suture nurse. Daily check of drugs used is kept in a record showing the drug administered, the amount, the patient's name and address, the name of the physician ordering the drug, and the signature of the nurse who administered it. A monthly record is kept showing the total number of patients operated upon, the number of major and minor operations, and the number of departmental cases. A yearly record is also made containing this same type of data, and in addition a yearly inventory is made of all instruments, classified as to their departmental use, and of all furniture and equipment.

NURSING ADMINISTRATION AND SERVICE

HELENE OLANDT, R.N., Brooklyn: The scope of nursing education includes the nursing care of the patient, selection of the nurses, supervisors, head nurses, assistants, and students, the direction of their activities, the planning of an educational program, and also co-operation with the other hospital departments such as the medical, the social service, the dietary, the occupational therapy, and correlation with public health departments.

Selection of graduate nurses should be carefully made so as to make sure that they not only have the proper academic background and good knowledge of the technique of nursing but also are versed in psychology and sociology. There should be at least as many graduates on the staff as there are students. If there is a school of nursing, there should be a teaching and supervision program on the wards as well as in the classroom.

Various means of distributing nursing care have to be devised in order to lower the cost. One of these, group nursing, will work if hospitals do not demand too long hours with too many patients assigned to an individual nurse. No nurse engaged in group nursing should have more than three private patients for 8 hours.

The question of ratio of nurses to patients is affected by such factors as the size and arrangement of the ward unit, the kind of equipment, the number of aides available, the type of patient, the number of treatments and the type of treatments ordered, the turnover in patients, and the amount of administrative work required of the head nurse. A study just completed at Bellevue Hospital, New York, showed that the average medical patient requires 110.7 minutes care in 24 hours, and that if the student nurse is on duty 52 hours a week it would mean that the ratio of nurses to patients would be 1 to 4 in 24 hours. The time required by the average surgical patient per 24 hours was 5 minutes more than for medical patients, making the ratio for surgical wards

1 to 4.2. The ratio of general duty graduate nurses to patients was, on this basis, 1 to 5, and the impression from the study was that the graduate could accomplish more work of a better quality in a given time than could the student.

A graduate nurse should have charge of the ward. It is her duty to see that patients receive the kind of care indicated, to make rounds with the physician and to see that his orders are carried out, to make sure that supplies and equipment of all kinds are kept on hand and in repair, and to keep an eye on ward housekeeping. If there are students in the ward, she should have an assistant. It would seem that there should be at least one assistant head nurse for every ward with 20 to 40 patients and 5 to 10 students. The head nurse and her assistant are responsible to the supervisor, who is in turn responsible to the director of supervision.